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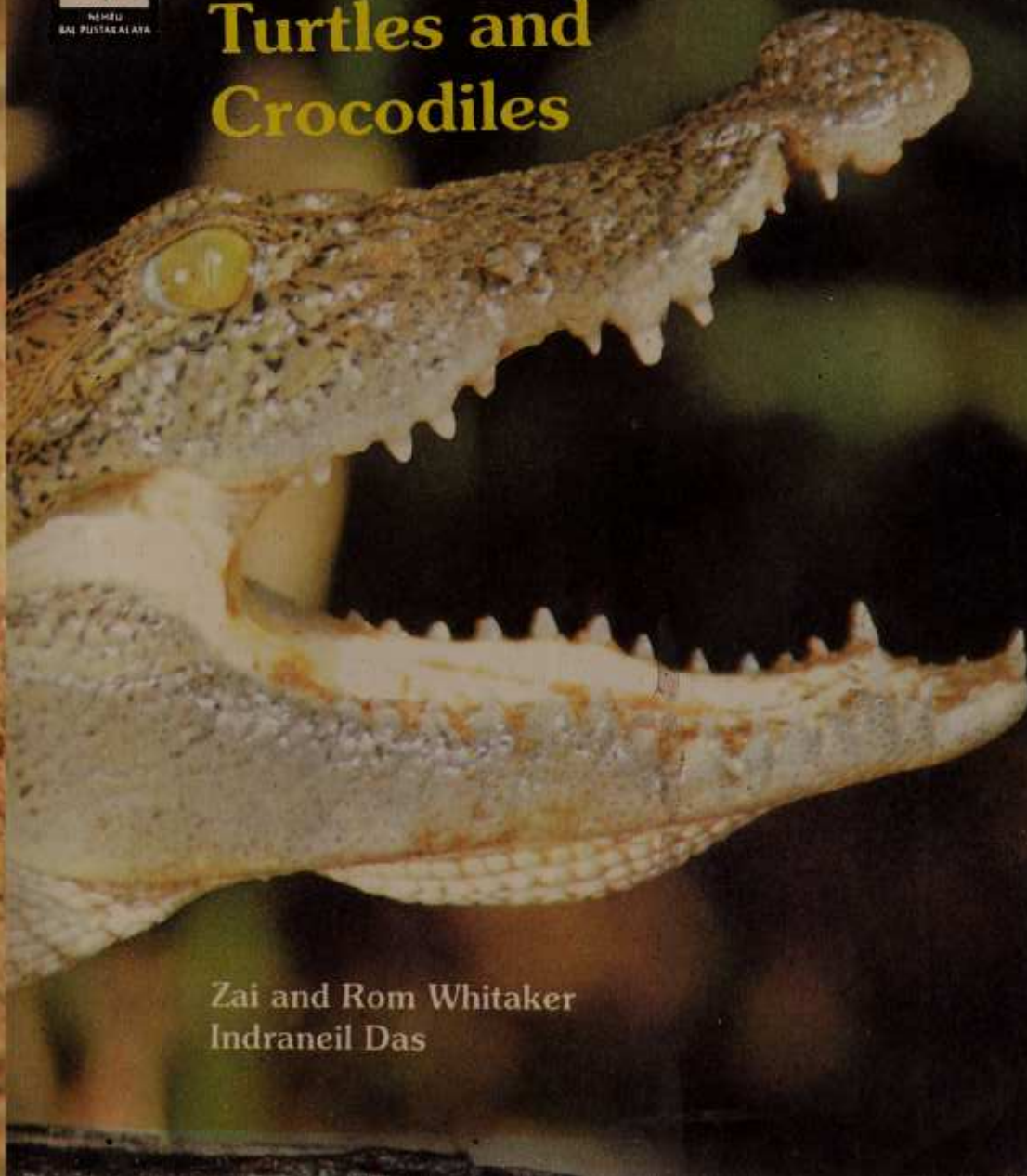
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NARMADA
SAHITYA AKADEMI

The World of Turtles and Crocodiles



Zai and Rom Whitaker
Indraneil Das

Nehru Bal Pustakalaya

THE WORLD OF TURTLES AND CROCODILES

Indraneil Das and Zai and Rom Whitaker

Photographs Rom Whitaker Drawings Indraneil Das

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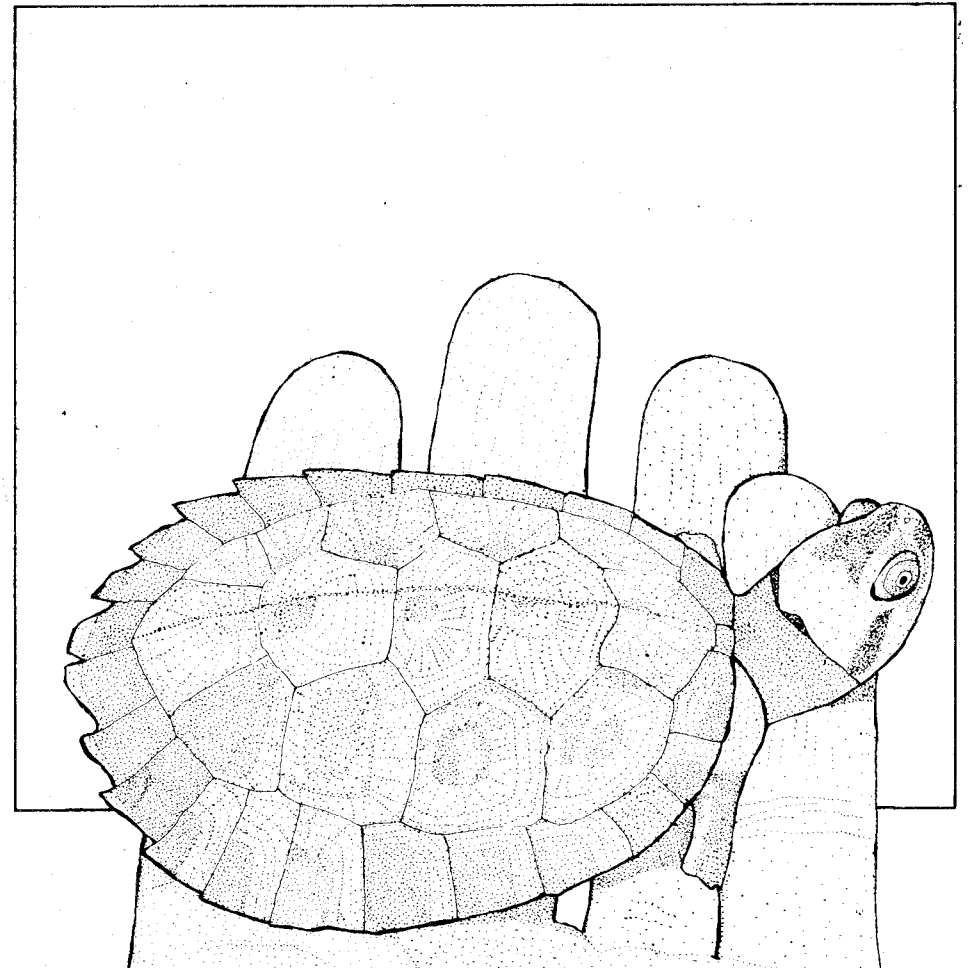
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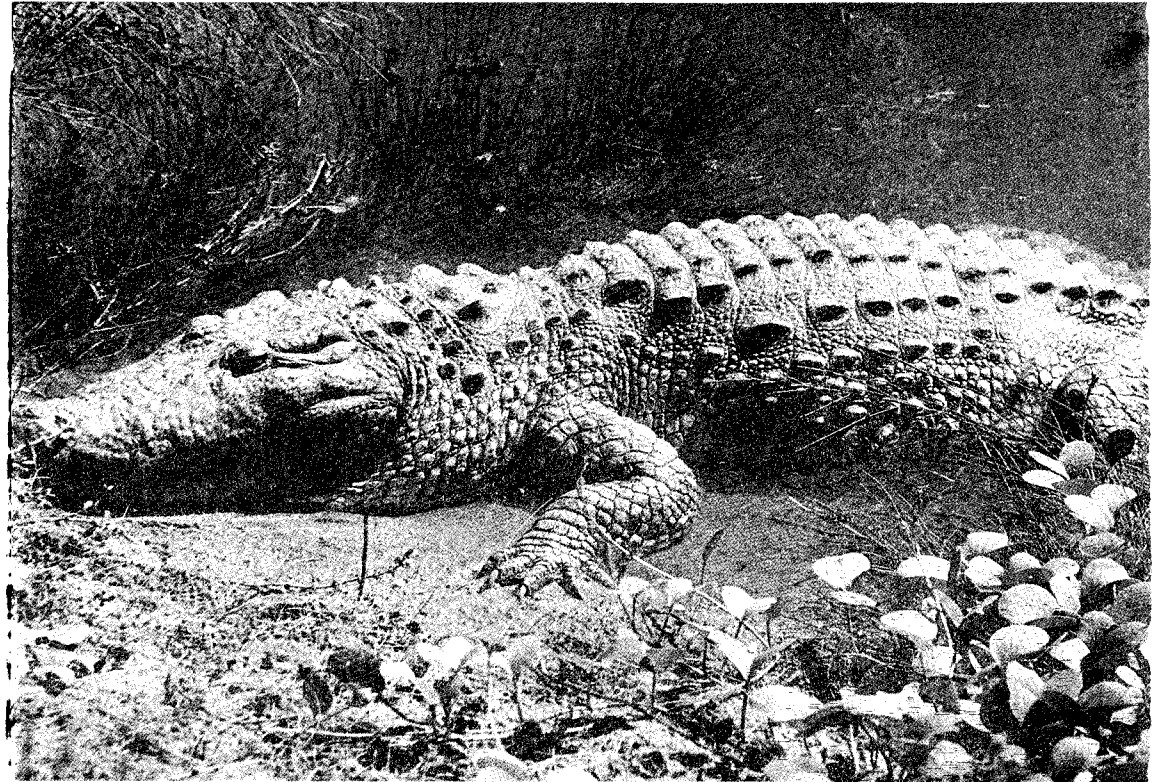
to bask in the sun and lay eggs. So do crocodiles, and we have often seen crocodiles and turtles basking on the same river bank. Of course, the turtle is ready to dive into the water if a big croc comes too close for comfort!

Turtles and crocodiles sometimes come on land at night to hunt for food such as insects, frogs and rats. Or they might leave a drying pond or river in the dry season and walk overland for long distances, even several kilometres, to find a new home. Some turtles grow big enough to eat smaller crocodiles. Once crocodiles grow up, the tables are turned and they crunch up any turtles that are slow enough to get caught. But most of the time life is peaceful for turtles and crocodiles in swamps, streams and ponds. Sometimes, a bold turtle might even use a crocodile as a log to bask on!

India has many different kinds of turtles and tortoises, each with different ways of making a living. Some eat plants, others eat insects, fish and frogs. Crocodiles, on the other hand, are all carnivores—that is, they eat only meat and fish. There are three kinds of crocodiles in India, and at one time, not so long ago, all three were common. But, like many other animals, they were killed for their meat and skin, and their natural habitats destroyed for planting crops, building houses, and dams. One of the crocodiles, the gharial, eats only fish. The mugger (or marsh crocodile) and the saltwater crocodile eat anything that moves as long as it is the right size: rats, frogs, snakes, crabs, deer, turtles, fish and birds are all on the menu.

Saltwater crocodiles live in mangrove swamps along the coast. These, and sea turtles, are among the few reptiles that are able to live in salt water. They have special glands which help them get rid of excess salt in their bodies.

As you know, turtles and crocodiles are reptiles, like snakes and lizards. These are all amazing animals that we should learn about. For many years, all that people would say about reptiles was 'Ugh'!



Mugger

But this attitude is slowly changing. We are learning that reptiles play a very useful role in our environment, and need to be protected and studied.

Let's take a closer look at the world of turtles and crocodiles.

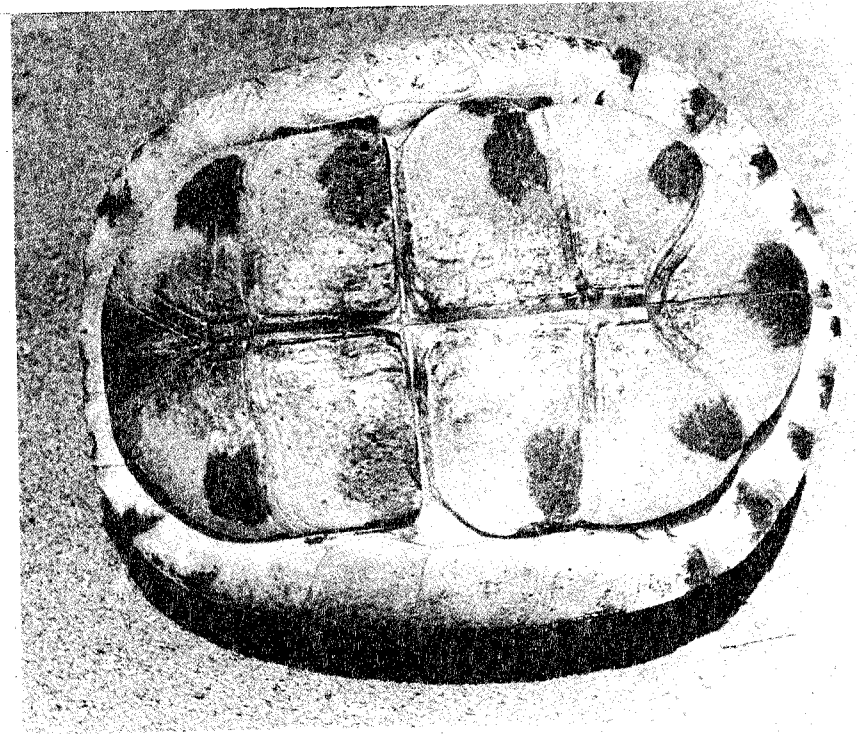
TURTLES AND TORTOISES

Most of us are afraid of crocodiles, and we wouldn't really like to touch one. But we love turtles, with their wrinkled little faces, dome-like bodies and funny, wobbly walk. More important, they have no fangs or poison, and usually don't bite.

Tortoises, turtles or terrapins? Three confusing names. Which is which? Someone wrote a poem about this problem:

All tortoises are turtles,
but not all turtles are tortoises.
All terrapins are turtles,
but not all turtles are terrapins.
Some turtles are just turtles.

So we find that 'turtle' is a good general name for tortoises, terrapins and turtles. The 'true' turtles, however, live in freshwater ponds and rivers, and are either hardshelled (terrapins) or softshelled. There are eight kinds of sea turtles in the world, and



The impregnable pill-box, the plastron of a Malayan box turtle, showing the hinge that totally covers the soft parts of the body

they only come ashore to lay their eggs. The hawksbill turtle is one of these and it is sometimes called the 'tortoise-shell turtle'. Confusing! Again, the dinner-plate tortoise of Australia is actually a

freshwater turtle. These names are misleading, and we need only remember that most of the time water-dwellers are called turtles, and land-dwellers, tortoises.

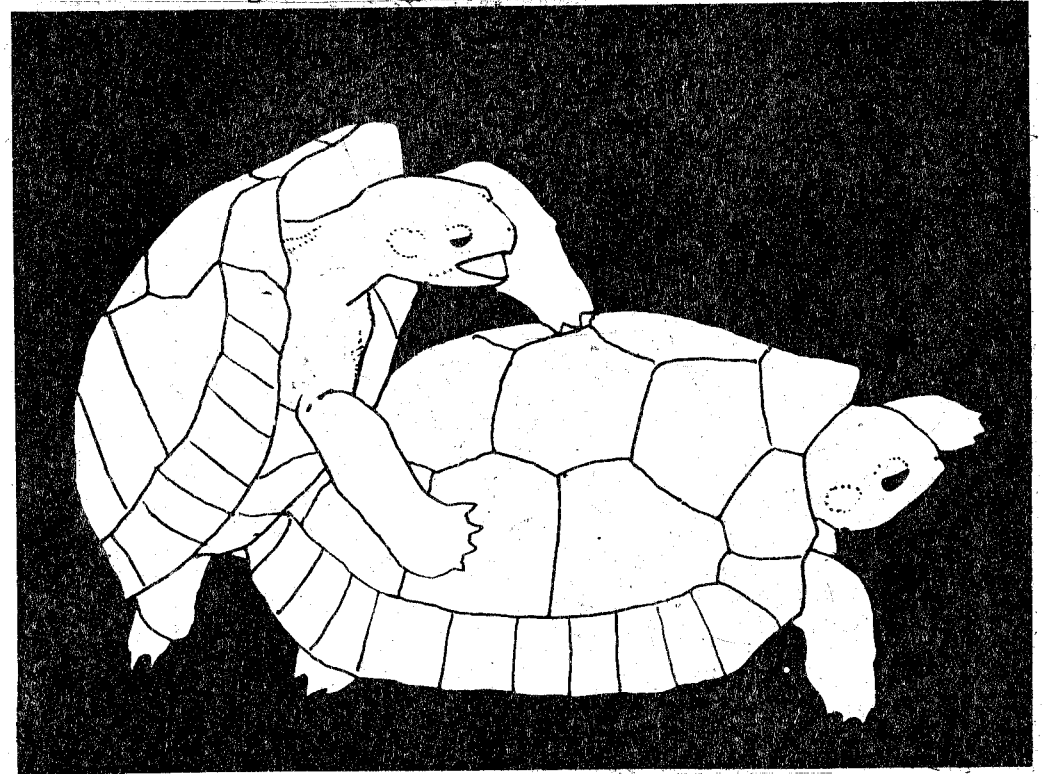
Some turtles are drab, and look like rocks, while others have beautiful, colourful shells. No animal can boast of having an armour as strong as the turtle's shell. The box turtles of North America and South-east Asia can support weights two hundred times greater than their own! Living as they do in habitats where predators such as tigers, leopards and crocodiles abound, it is very useful to have a super tough shell.

Most turtles are voiceless and do not make any sound. Some male tortoises, however, are noisy during the breeding season, probably to frighten the females into submission. We have heard star tortoises grunt, Travancore tortoises gasp, the South American red-footed tortoise cluck and the Galapagos giant tortoise bellow! The Asian giant tortoise, which is found in north-eastern India and elsewhere in South-east Asia, is said to roar and the big-headed turtle of Indo-China growls when annoyed. Biologists report other noises made by these animals, such as grunts and whistles when laying eggs, and the choruses of Travancore tortoises on rainy nights.

Turtles have been around for a long time. Their fossils have been found in rocks that are over 200 million years old; this was when dinosaurs were beginning to evolve. The species we see today differ very little from the earliest ones, and this proves that they are 'successful' animals. They were able to adapt to the dramatic changes on earth, such as in the climate, vegetation and the arrival of the mammal age.

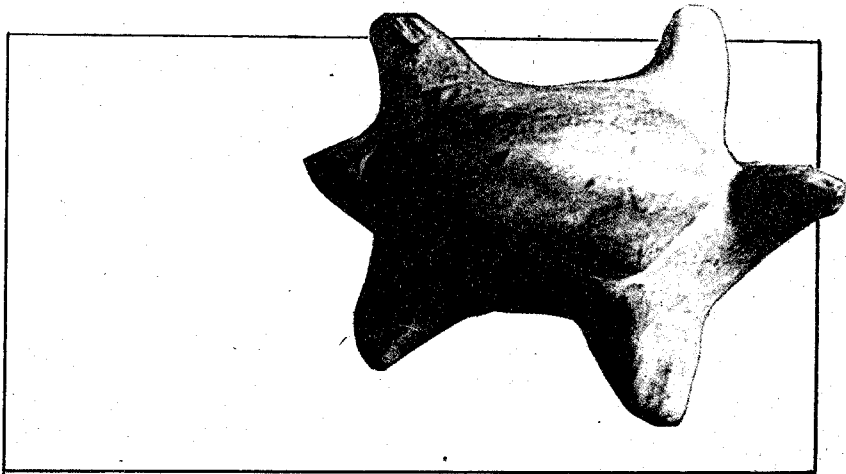
All the turtles and tortoises found in India can pull their heads into their shells by bending the neck into an 'S' shaped curve. This

means they are vertical-necked. In South America, Australia and Africa, there are 'side-necked' turtles. These have very long necks which cannot be pulled in, and are folded to one side; which is not very efficient against predators. This variety lived in our country in the prehistoric past. Another ancient Indian species was the Siwalik tortoise, a gigantic animal with a shell almost two metres long! The carapace or upper shell could have been a bath tub for an adult human being, and two people could comfortably sleep in it.



Mouth open, a male Travancore tortoise tries to mount a female

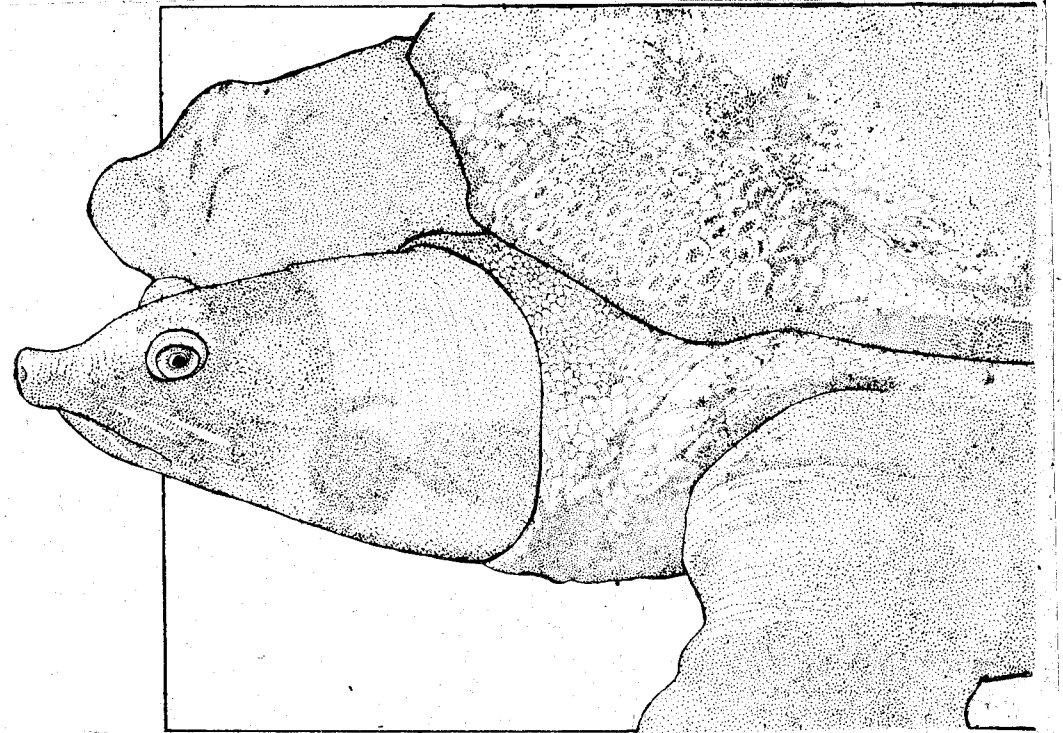
Like their close relatives, snakes and lizards, turtles are 'cold blooded'. While we spend much of our energy in keeping warm, reptiles have another strategy: they get their temperature from the surroundings. By moving in and out of the sun, or the water, they get warm or cool off. So basking in the sun is an important activity and sometimes you will see the head, neck and limbs of a turtle stretched out in a relaxed pose. While the main function of basking is to raise the body temperature, biologists feel there may be other uses, such as helping in digestion, getting rid of parasites like leeches, ticks and mites, and even helping in the manufacture of Vitamin D.



A toy leatherback turtle made some 4,000 years ago at Harappa

Turtles have excellent eyesight and several kinds are endowed with colour vision. In areas where turtle hunters are active, we have seen turtle heads quickly submerge in the water at the approach of

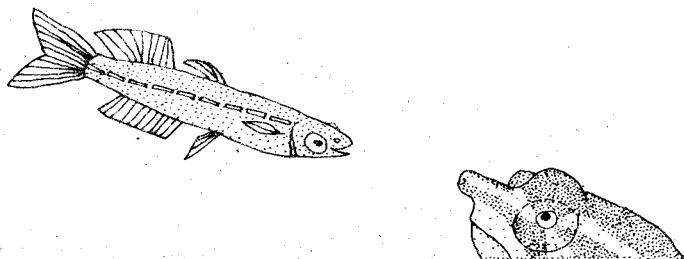
a human being. The clear vision is important in locating food. A turtle must be able to see a juicy green leaf or a bright red fruit, in a background of brown and yellow leaves and grasses. The sense of hearing in turtles and tortoises is moderately well developed.



Leith's softshell turtle, found in south India, is a very large species with a short temper. It can be identified by a patch of "warts" on its shoulder

Given the choice between fight and flight, turtles mostly choose the latter, which means ducking into their shells. There are some, however, that don't give up easily. Softshell turtles, as if to make up for their soft and edible bodies, are great fighters. We have found,

to our discomfort, that they bite, claw, and sometimes hit out with their heads. The narrow-headed softshell turtle is reported to attack and sink small boats! When caught, it does not bite, but hits out with its curiously shaped head. Sometimes swimmers are bitten by large river turtles. And in the burning ghats on the Ganga and other rivers, turtles feed on corpses, helping keep the river clean and unpolluted. In fact, the Indian Government is now breeding turtles for release in rivers so that they can help keep these environments clean.



Surprise attack by a narrow-headed softshell turtle...

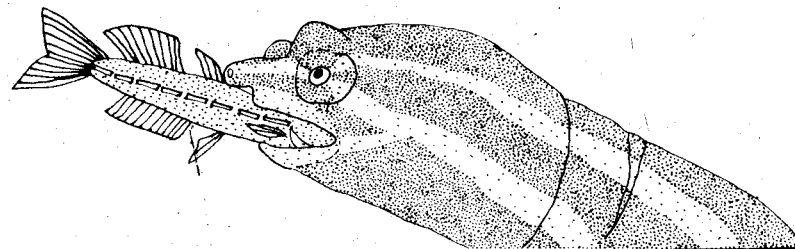
More often though, it is human beings that make a meal of turtles. There are remains of turtles in many prehistoric human settlements and these can also be found behind tribal huts all over India. Later, we will talk about the use of turtles today. As a result of our hunting turtles, many species have become rare, or disappeared altogether.

Habits of Turtles

Most turtles are not fussy about food, and eat various kinds of insects, fishes and water weeds. A few are selective feeders,

though, eating only certain foods. The narrow-headed softshell turtle found in the larger rivers of India and several nearby countries feeds on live fish. To catch these, it lies buried in the river bottom, with only the tip of its small head sticking out. Fish pass by, and some come over to investigate the pair of eyes; the turtle shoots out its long neck and catches them.

The sea-dwelling leatherback turtle feeds on the dangerous jellyfish, and its 'W' shaped upper jaw helps it cut this soft food. The hawksbill sea turtle relishes sponges and is able to eat them whole, including their spines that are actually made of glass. The



a long neck shoots out to grab an unsuspecting fish

narrow, beaked head is designed for cutting sponges and prying out clams, snails and other animals that live in coral reefs. Many of the sponges eaten are poisonous enough to kill others, yet nothing seems to happen to the hawksbill. On the other hand, people can die after eating this turtle. The sponge's poison is stored in the turtle's body without doing it any harm.

To come back to freshwater turtles, large softshells feed on both plants and animals. They are extremely powerful animals capable of pulling down ducks from the surface of the water.

Young crocodiles have also been known to fall prey to these turtles. We have seen a small Indian softshell turtle pull a fat green frog bigger than itself underwater by its leg and struggle with its outsized prey. When forced to surface for air it lost the still very active frog.

As scavenging is easier and often more productive softshells usually eat dead animals. A friend of ours once attached his camera close to a dead buffalo hoping to photograph a tiger. Instead he found photographs of large softshell turtles tugging away at the kill!

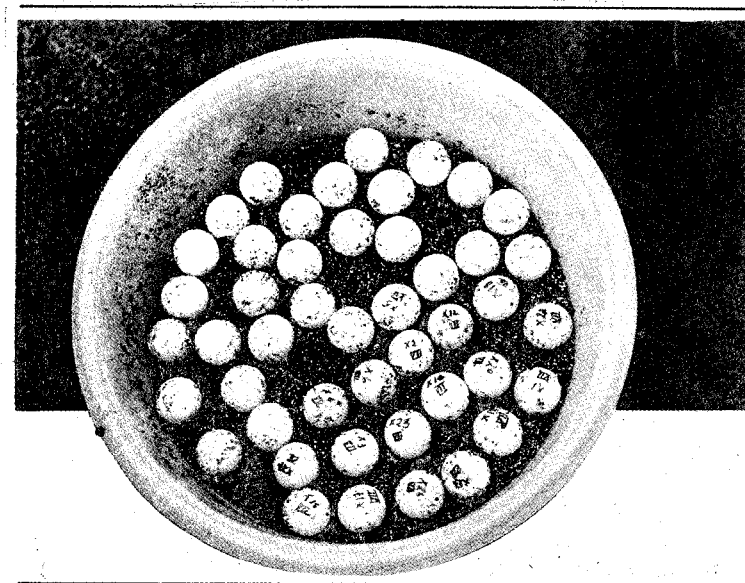
Most turtles start life as carnivores, eating any smaller animals they can overpower, or dead animals they may find. These are rich in protein, and the turtle grows fast. After reaching a certain size, they may become confirmed vegetarians, living on weeds. Famous examples of this feeding switch are the green sea turtles and the Indian tent turtle. Some turtles are cannibalistic, eating their own kind, and young ones are particularly at risk. When raising turtles, we find that the strong ones make short work of the rest, and we have to provide the smaller or weaker ones with good hiding places or keep them separate from the 'bullies'.

Breeding

Turtles and tortoises lay eggs. These may be round or long, and are laid in a hole in the ground. The time needed for the eggs to hatch varies a great deal. Depending on the outside temperature and other factors, it might take from a few weeks to several months. The young of many species hatch during the rains. There is a good reason for this. The rains bring out many plants and insects that are eaten, as well as plenty of water. The young turtle is thus well provided for. A tribal belief in some areas is that the sound of thunder tells the baby turtle inside the egg that the conditions

outside are just right for it to emerge. From what we have seen this may well be true.

The size and number of eggs laid vary from one species to another. Some tortoises lay a single large egg, while sea turtles regularly lay over a hundred eggs at a time! Freshwater turtles are somewhere in between. The Asian giant tortoise of the south-east Asian rain forests can lay fifty eggs at a time. Almost everything about this tortoise is unusual, including its weight: thirty kilos! It



Eggs of softshell turtles are nearly round. The temperature at which the eggs develop influences the sex in most turtles

lives in dense forests, lays its eggs in a pile of leaf litter, and guards them for several days against predators. All most unturtle-like characteristics. Tribals in its forest home claim that this tortoise can roar like a tiger.

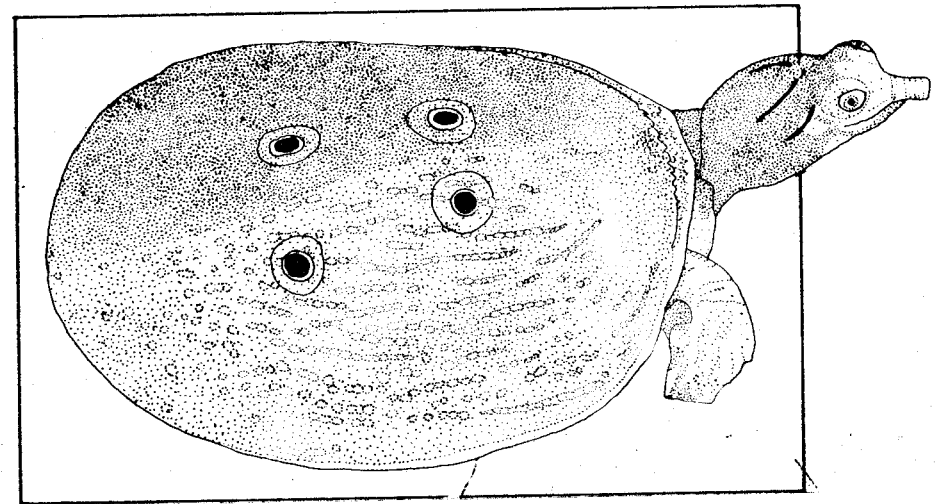
As soon as the eggs are laid, they are at the mercy of many eager predators, who have been waiting for the egg-laying season. However, we know of one case where a turtle egg fooled its predator. It was swallowed by a snake, and then excreted without being digested. A live baby turtle hatched to tell the tale!

Enemies

Despite the very tough shell, enemies, including human beings sometimes get the better of turtles and tortoises. There is a long list of animals that eat them, including tigers, hyaenas, pelicans, otters, crocodiles, monitor lizards, wild boars, crabs, mahseer fish, and even the nilgai, which is a kind of antelope. Turtles, however, have some tricks up their sleeves, or rather, shells. The flapshell turtle, the commonest of the Indian freshwater turtles, smears its attackers with an evil-smelling, yellow liquid. Tortoises excrete freely when caught and handled, as biologists have found out to their dismay. The young ones of some softshell turtles have four to six eye-like markings on the upper shell, which are thought to frighten away enemies. You must have seen such markings on butterflies and moths, caterpillars, fish and lizards. The markings disappear with growth. The larger turtles, with their more powerful jaws and greater speed, are better able to deal with their natural enemies. All the softshells are fast swimmers.

Where they Live

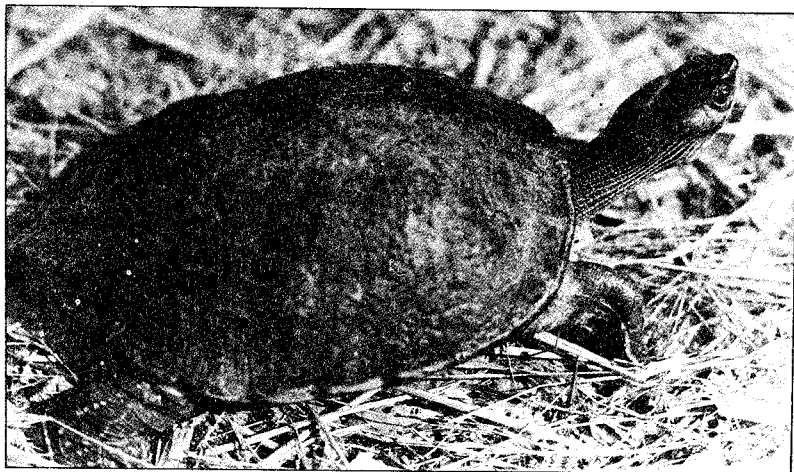
Nature has a wonderful and efficient way of distribution. Each species of turtle and tortoise chooses a different kind of place, or habitat, to live in, so they avoid competition and there is enough food and space for all. The Travancore tortoise prefers the damp forest floor covered with leaf litter. The star tortoise lives in scrub



Eye-like markings on the shell of a young Ganges softshell turtle probably help to scare away enemies

country, where summer temperatures get to over 45° C during the day. The elongated tortoise, called the 'tree tortoise' in Bangladesh, is another forest dweller, and local people claim that it can climb trees! Several turtles have left water altogether and have taken to life on land. Perhaps the most famous of these in India is the cane turtle, which has an interesting history. It was thought to be extinct, but was rediscovered by the biologist J. Vijaya in the 1980s in the forests of Kerala. This is India's smallest turtle; an adult of this species would fit comfortably into your hand. The three ridges on the dull brown shell make it blend with the dead leaves on the forest floor, where it hunts millipedes, snails and beetles. The Kadar tribals search for cane turtles to eat, using hunting dogs.

Males and females of the same species are sometimes different in colour and structure. Males, as a rule, are more brightly coloured. Some, like the painted roofed-turtle and the cane turtle have red, pink and orange breeding colours that are thought to attract the females. In males of many species, the plastron or lower shell curves inwards, so as to fit the female's shell during mating. The sizes of the males and females of the same species may also be different. In the Brahminy river turtle, females may be three times larger than the males. Confused by the size and colour differences between sexes, local people sometimes have different names for the same turtle.



One of the brightest and commonest of the hardshell turtles, the Indian roofed-turtle, has a shell raised like a roof and numerous stripes along the neck

Sea Turtles

There are eight species of sea turtles in the world and the strangest is perhaps the leatherback, which is so different from the others



Difference between the sexes in the Indian star tortoise: the female (above) is clearly larger than the male (below)



that scientists had to create a separate family for it. Leatherbacks are the largest living turtles. One which was recently washed ashore on the coast of Wales weighed a tonne, and measured over 2.5 metres (8 feet)! Whereas other turtles become adults in ten years or more, this species matures within two years, increasing its body size 30,000 times in the process. Although leatherbacks nest on tropical beaches, they roam the seas far and wide. These giants of the sea have even been seen in the freezing waters of the Arctic and the Innuits (Eskimos) make poems and drawings of the animal. How can this 'cold-blooded' reptile tolerate the extreme cold of the northern seas? Biologists have not been able to solve this puzzle. Another startling fact about leatherbacks was recently reported by scientists from the University of Georgia, in the United States. They found out that these animals can dive as much as 1,200 metres (over half a mile) below the surface of the sea. This is the deepest dive known for an air-breathing animal, deeper than the mighty sperm whale. These deep dives are thought to be performed to catch prey, mainly

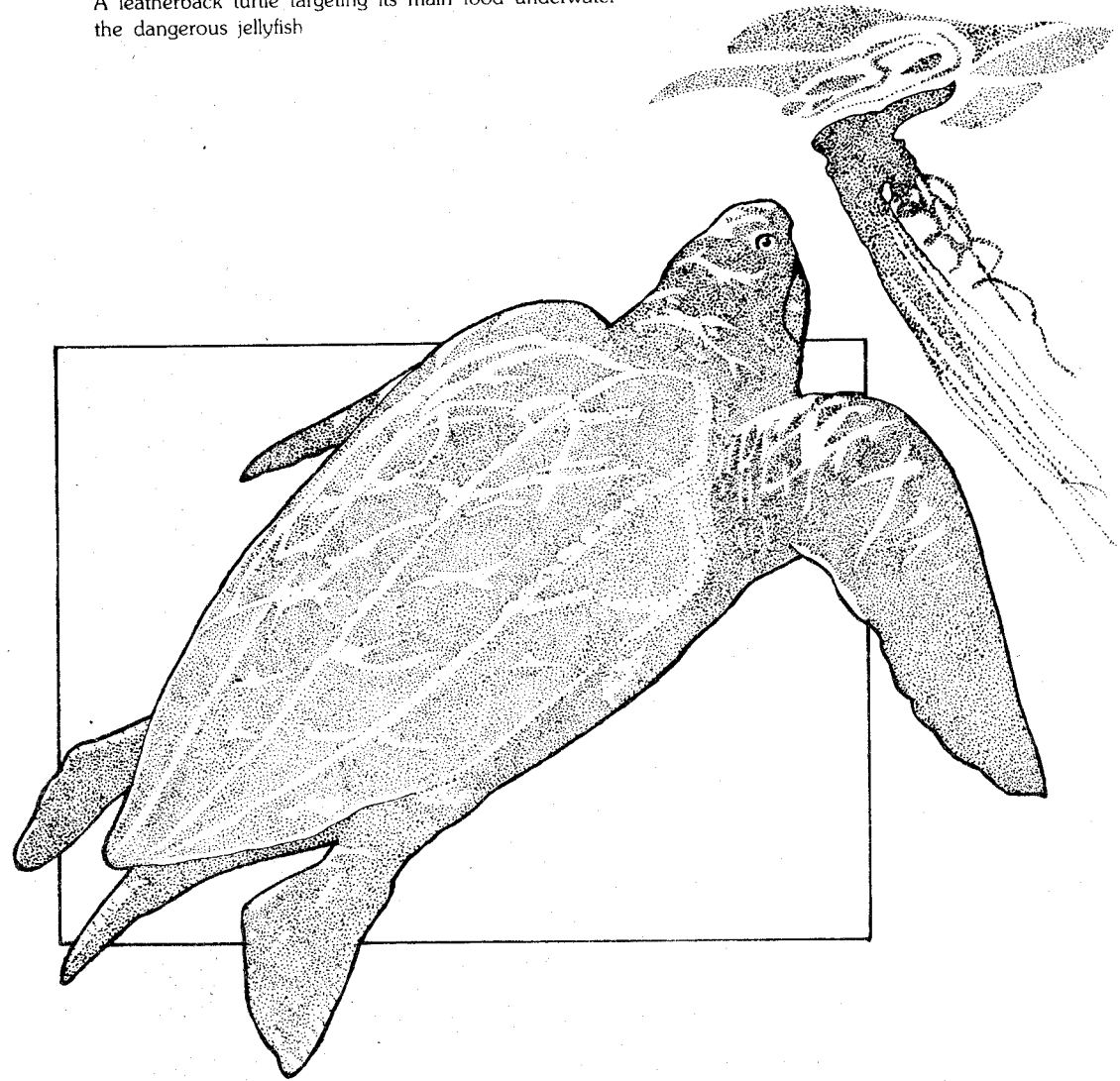
jellyfish. Perhaps the thick layers of fat, the soft skin and the skeleton made of cartilage help them tolerate the water pressure in the deep.

There are nesting grounds of the leatherback in the Andaman and Nicobar Islands. They once nested on the Kerala coast, but have abandoned the area as there is now too much human disturbance.

But the commonest, and also the smallest, sea turtle in India is the olive ridley, found on the east and west coasts as well as the Andaman and Nicobar islands in the Bay of Bengal. Tens and even hundreds of thousands of them come up together on the beach to nest during certain nights in the winter and spring. This type of nesting is called an 'arribada', which means 'arrival' in Spanish, and is unique to the olive ridley and its close relative, the Kemp's ridley of the Atlantic. On arribada nights you can hardly walk on the beach—every bit of the sand seems to be covered with a turtle! Millions of eggs may be laid in one night. This way at least some of them escape being eaten by predators. People say that less than one in a thousand of the eggs laid ever produces a baby turtle that will live to become an adult. The most famous turtle beach in India is Gahirmatha, in Orissa, within the protected Bhitarkanika National Park. Once we watched 20,000 ridleys come ashore, but the night before over 200,000 had nested there!

For a long time, the olive ridley was confused with another turtle, the loggerhead. But while ridleys are only half a metre in length, loggerheads grow up to a metre long. Ridleys have a grey-green shell and a small head, while the loggerhead has a reddish brown shell and a massive head. Both species have somewhat similar habits and needs, so nature has separated them: thus, the ridley is common on Indian coasts, but the loggerhead is very rare.

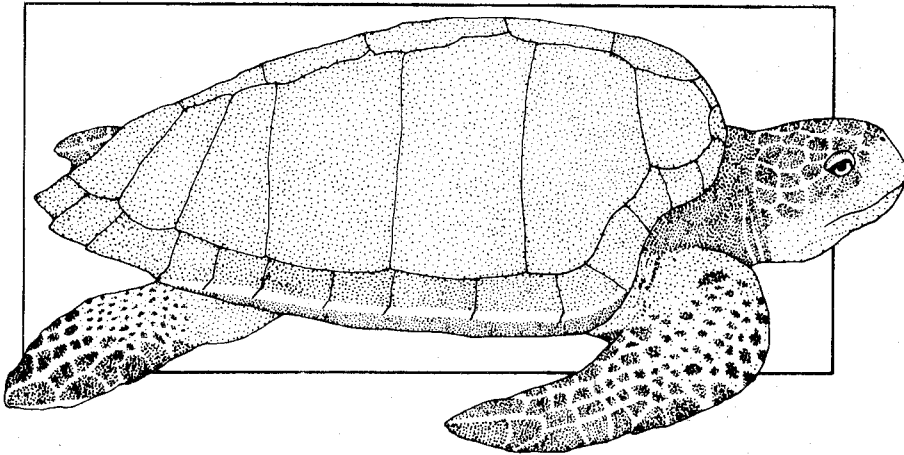
A leatherback turtle targeting its main food underwater—the dangerous jellyfish



Sea turtles remain in the open sea during most of the year, coming ashore to lay eggs. Watching a sea turtle dig a nest and lay her eggs is to see one of nature's miracles. She refuses to be disturbed once she starts laying. The tears streaming down her eyes keeps them clear of the sand she flings around and gets rid of the extra salt absorbed in the sea. She takes great trouble covering the nest and pounding the sand flat by rocking heavily back and forth, very much like a clumsy dancer.

On hatching, young turtles dig out of the nest and rush to the sea. Until recently we knew nothing about the period in the sea turtle's life between hatching and adulthood. How did young turtles survive in the deep ocean? After years of study, the turtle biologist, Dr Archie Carr, solved the puzzle of the 'lost years'. He found that young green turtles head for places in the sea where

The familiar olive ridley sea turtle found on both coasts of India and around islands, nests in thousands on the east coast



different bodies of water come together, bringing with them driftwood, plants and animals. This forms a very unique ocean habitat and the young turtles grow up in these 'nurseries of the sea.'

Other turtles also nest in large numbers together, though nowhere near the fantastic arribadas of the ridley. The river terrapin, a large hardshell turtle with a funny turned-up nose, also nests in groups. It is found in the mouths of large rivers in eastern India and other countries further east. Unfortunately this salt-loving terrapin has been killed in large numbers, making it very rare. It feeds on the leaves and fruit of mangrove plants, which grow in salty river mouths. But man thinks that mangrove wood is necessary for his needs, and is destroying the animals' habitat.

An upturned nose that helps it to breathe with the rest of the body underwater is typical of the river terrapin



Living with Humans

Man has used turtles since the earliest times, for food, ornaments, as pets and 'medicine'. The extremely hard shells of most turtles enable them to be well preserved and, as mentioned earlier, many have been found in prehistoric dwellings. The ancient Egyptians considered the turtle to be evil and, while worshipping the Sun God Ra, sang:

"May Ra live, and the turtle die."

For Hindus, the tortoise is an avatar of the god Vishnu, and is depicted in many paintings, legends and temple carvings. Ancient Hindu texts say that the earth is supported by a giant turtle. Strangely, the same sort of belief is found among the North American Indians. And Chinese legends say that Kwei, an ancient turtle also called Lord of the Northern Quadrangle, created the universe.

Tribes all over the world believe they have descended from turtles, and do not eat turtle meat. But for the most part, turtles are widely killed, for a variety of reasons. Turtle meat is full of protein, is cheap and is therefore eaten in many parts of eastern India. Elders relate how they saw huge river turtles in large numbers fifty years ago... but this has changed. Too much fishing, collection of turtle eggs for food, river pollution and building dams and reservoirs, are some of the ways man has wiped out turtles. This is indeed sad, since they are a very valuable part of our environment.

Several religious shrines have large tanks with turtles. At the Muslim shrine near Chittagong in south-eastern Bangladesh, we have seen large, and very pampered freshwater turtles. The people here believe the turtles to be 'djinnns', or evil beings transformed into turtles as punishment by a saint. Evil or not, these turtles get much attention, and food, from pilgrims.



In the form of Kurma, the giant turtle, Vishnu plunged into the ocean to retrieve the vessel containing the nectar of immortality

For a long time, people have been throwing dead bodies into the Ganga, knowing that the crocodiles and turtles will take care of them. Village folk appreciate this habit of turtles. There is a Bengali saying that the chant of pall bearers during a funeral procession attracts turtles. But today turtles are not as common on the Ganga and they cannot adequately perform their role as river scavengers. That is why the Indian Government has started a breeding and hatching programme to put turtles back into the rivers.

There are other ways in which turtles benefit us. They feed on water weeds, and keep waterways clear. Green turtles, called the 'cattle of the seas', feed on sea grasses. They convert useless weeds into valuable red meat for tribal people living on sea coasts and islands. These people often have no other source of meat. By eating snails and insects, turtles also control diseases spread by these creatures.

We use many methods to study turtles and tortoises in the wild. In the past, the only way people knew of studying these animals was to cut them open, but now this is avoided as it is wasteful and cruel. To track the movement of a turtle, a spool of string is tied to the shell. You can tell one turtle from another by cutting notches on the shell. Tagging is another way of identifying turtles. A piece of plastic or metal, sometimes with a name or number, is attached to the front legs. Biologists X-ray females to see how many eggs they are going to lay. The long-distance movements of turtles and tortoises are studied by fixing a tiny radio transmitter to the animal's body. This gives out a signal which can be picked up by a receiver. All these exercises help us get more information on turtle biology and learn what must be done to protect them.

Dwindling Fortunes

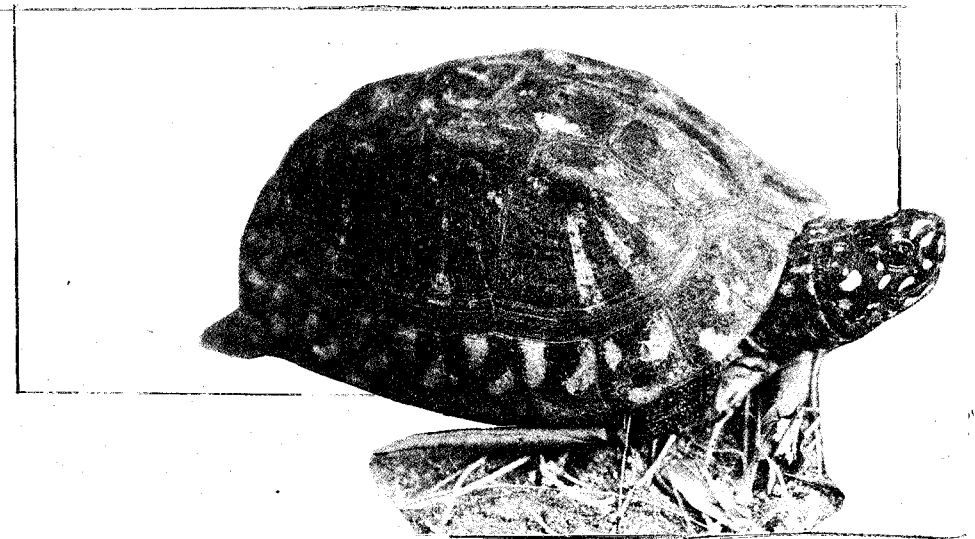
It is amazing that animals which have survived for 200 million years, living with dinosaurs as well as primitive man, should be threatened by 'civilized' people! It is said that all parts of a turtle are used by man: meat, fat, bones, shell, scutes, blood—everything has value. Several medicines are made from the parts of a turtle's body which are thought to cure various illnesses, such as piles and indigestion, none of which has been shown to work. Turtles are killed in different ways, mostly very cruel. Sometimes they are flipped over on their backs and cooked over a slow fire, so that the meat cooks in the shell. In big city markets, the plastron, or lower shell, is cut away to let customers choose the 'cut' they want. In Tuticorin, in Tamil Nadu, there was, till recently, a 'Sea Turtle Blood Drinkers Society', which drank sea turtle blood, claiming it was good for their health!

Is it right to use animals like turtles for meat? Yes, if they are

farmed or harvested properly. After all, an adult green turtle has a hundred kilos of good, rich meat. Many tribals throughout the world depend on sea turtles as a source of protein, but they usually take only as much as they need, and thus protect the population of the animal they eat. It is us 'civilized' people who manage to finish off wildlife through our greed. The meat of leatherbacks is not tasty, but the oil is used for boats and woodwork. The biggest threat to these giants of the sea, besides killing for oil, are small floating plastic bags. Leatherbacks swallow these, mistaking them for jellyfish, and die. The seas must be kept clean and free of such garbage.

But there is hope for turtles and tortoises, even though many species are already extinct or about to become so. In recent years, we have learnt a lot about the natural history of turtles, and how

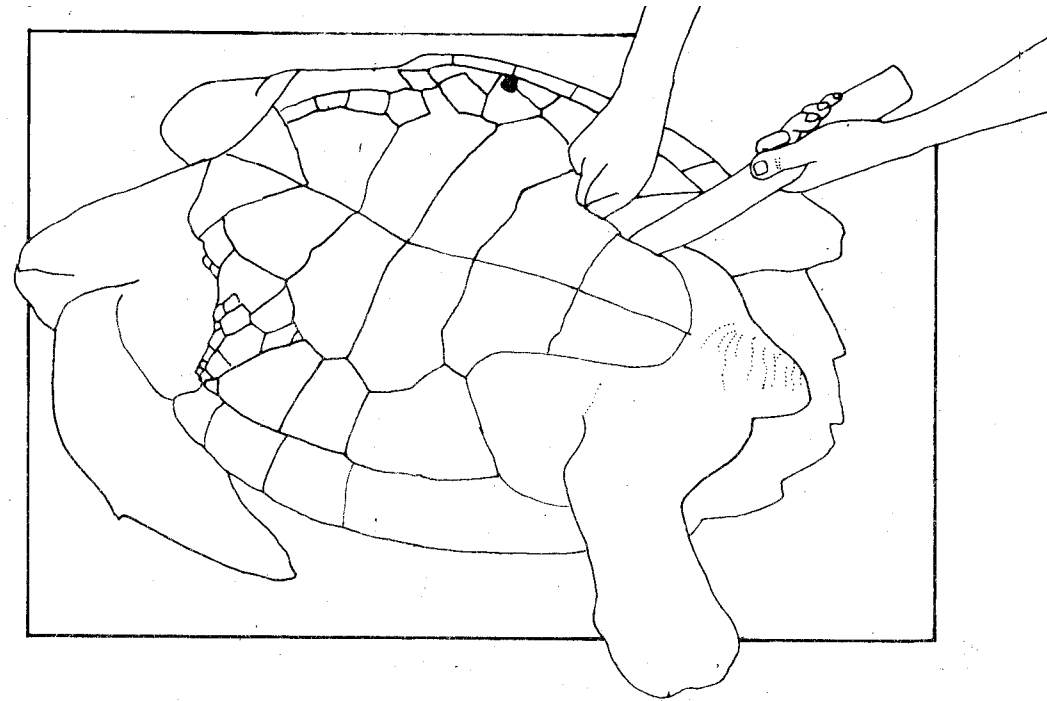
Spotted pond turtle, the ghost turtle of the Bengalis, is a beautiful species



they are threatened. Now people all over the world are trying to save them. Sea-turtle eggs are collected from beaches and hatched in captivity. Eggs hatched in laboratories produce a 90 per cent hatch rate and most survive and grow. The young ones are released into the sea. This is done because most eggs are destroyed by human beings, dogs and wild predators, and never hatch. Sometimes, young turtles are reared for several months or years so that, when released into the sea, they are large enough to avoid their natural enemies. This is called 'headstarting'. A word of caution: it has now been discovered that the temperature at which the eggs develop influence the sex of the turtle. Hence, unless one is careful hatcheries may cause more damage to turtle populations, producing either all males (low temperatures) or all females (high temperatures). 'Headstarting' is suspected to result in 'tame' turtles that have lost their instinct of survival in the wild.

Habitats which are free of human beings, have larger populations of turtles than those which are heavily populated and spoilt by man's activities. Certain turtles can only live in a particular kind of area. An example is the large river terrapin found in mangrove forests. At one time the Salt Lake marshes, east of Calcutta, were connected to the mangrove forests of the Sunderbans. River terrapins lived there. But about a hundred years ago the connecting creeks were blocked to make big fish ponds, and to build houses. Terrapins, deprived of food and shelter, vanished from this area.

If we allow turtles to be eaten, we must farm them. This is being done in many countries. Turtles are also being farmed so that they can be 're-stocked' in the wild, as they are important links in the chain of nature. The water hyacinth, a weed from South America, has become a pest in many areas of the world, blocking water



Turned turtle, a ridley is slowly done to death by cutting away the plastron with a sharp knife

channels and harbouring malaria and other diseases carried by mosquitoes. But many of the turtles found in our ponds and rivers feed on this plant, and some even feed on mosquitoes! The farming of such turtles can control disease in these weedy habitats.

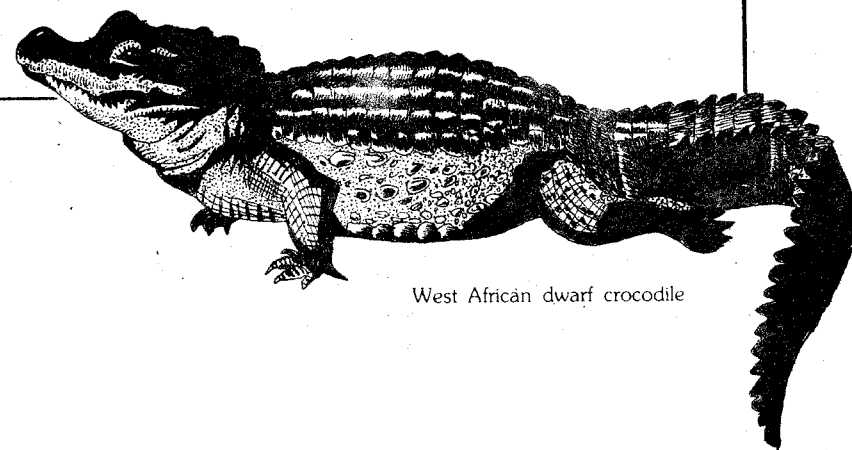
Sadly, all the turtles we see in our markets are caught in the wild. Sea turtles are caught by the thousands off the east coast. They are trapped in shrimp nets, even though it is illegal, and while some are taken to markets all over West Bengal, many drown and are simply thrown out of the net, to be eventually washed up on the beach. Some coastal people use the remora, or sucker fish, to catch sea turtles. On sighting a turtle, the fisherman releases the

fish, which sticks to any such large animal it encounters. With a few remoras attached to its body, there is no hope of the turtle getting away. In other countries, hunters use wooden models of turtles to attract male turtles towards their boats. Sea turtles are also harpooned, or caught with bare hands as they swim past a boat. Even the smaller species are not left alone: star tortoise shells are sold as 'curios' in sea-shell shops in south India.

Tortoises are gathered from land for another purpose—for the pet trade. This is harmful, since most of the animals are bought for children who do not know how to look after them, and they soon die. Turtles and tortoises may be kept for short periods in aquariums or other suitable enclosures, in conditions as close to their natural environment as possible. Drinking water should be provided even for 'water-shunning' varieties, such as desert tortoises. Most baby water turtles enjoy live food small enough to be captured, while tortoises are fond of juicy fruits and leaves.

We must all make an effort to ensure that the turtles and tortoises that live in our country do not become extinct. If you have become interested in these beautiful and useful animals, read more about them, see them at zoos and the Madras Crocodile Bank and try to find them in ponds and rivers. You can always write to the Crocodile Bank if you want to know more about them. There is one great advantage in studying turtles: they can't run away too fast!

CROCODILES



West African dwarf crocodile

Big teeth and a knobby, ancient looking skin: this is our first impression of a crocodile. From early childhood, the stories we hear and read about crocodiles tell us that these are not likable animals. But people who study crocodiles have found that the truth is otherwise. After you have read about the three species of Indian crocodiles, make up your own mind. You might end up liking these



Crocodiles are one of the most maligned creatures. A fanciful 1834 illustration from *The Oriental Annual* shows this beast getting the better of an elephant.

kings of the water, just as we do. For one thing, they have a lot in common with human beings. They have a good sense of smell, sight and hearing. They can make loud noises, and they come to each other's defence. The parents look after their eggs and young with great care, just as we do!

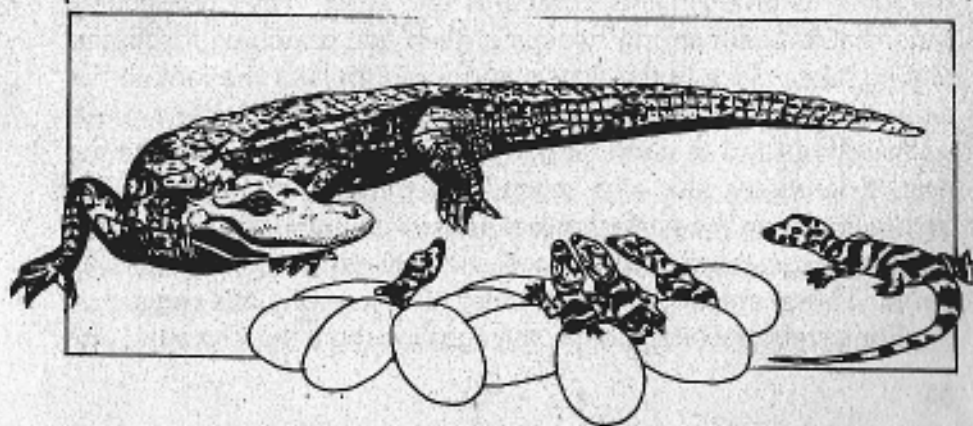
The Mugger, or Marsh Crocodile

The mugger is India's freshwater crocodile and lives in streams, rivers, lakes and ponds almost throughout the country. It is a rough-skinned reptile that grows to over 4 metres (13 feet) in length, and may weigh over 300 kilograms.

We have seen muggers catch and eat a variety of creatures. The young are good jumpers. They spring up from the water to snap a dragonfly and regularly catch small crabs, fish and frogs for lunch. As they get bigger and older, they may still eat bugs and frogs but also catch snakes, birds and rats. Still bigger muggers may catch a wild pig or deer. They also eat dead animals found in or near the water and help keep the environment clean. Fish are an important part of the mugger's diet. When streams and ponds dry out in the hot season, fish are easy to catch in the dwindling waters.

Crocodiles usually know the size of animal they can handle, and rarely attack anything too big. Once, Rom was washing his hands in the croc pond after a muddy session of measuring

Females of many crocodiles and alligators, such as this Chinese alligator remain to guard the nest after egg-laying and help the young ones to come out of the eggs.

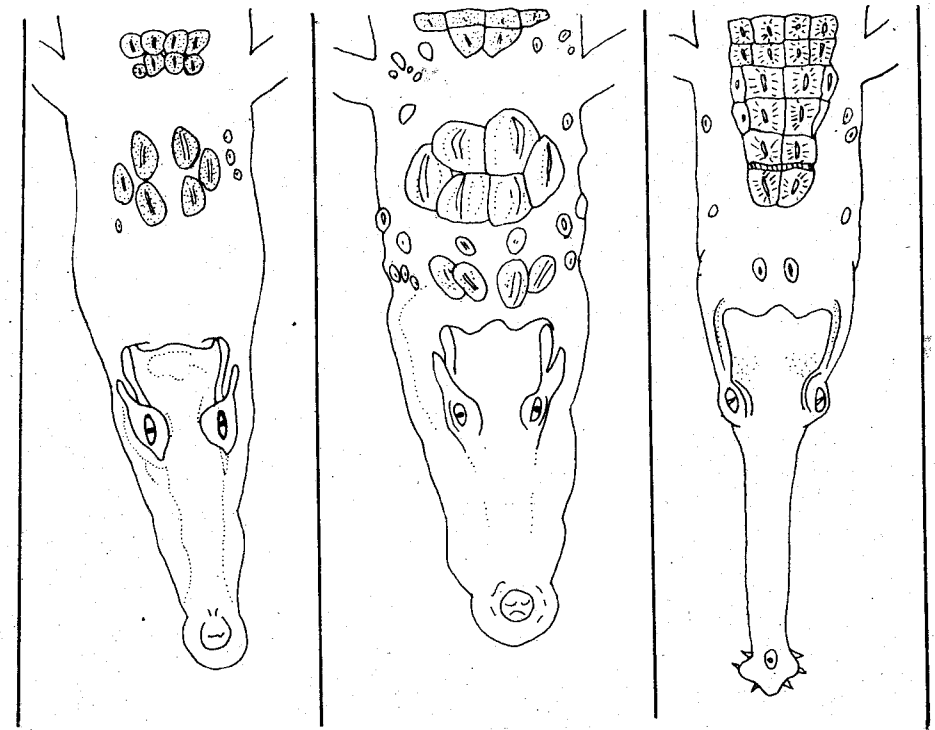


crocodiles when, quick as a flash, one of the big males took hold of his hands and came to the surface, blinking the water out of his eyes. In that split second, the croc did some quick thinking. It decided that this thing was too big for a meal, and gently let go of Rom without even making a scratch on the skin.

At the Madras Crocodile Bank, the six thousand crocodiles are fed every other day. We buy two tonnes of fish, meat, rats and mole crabs every week. Crocodiles don't really eat as much as people think. For one thing, they don't require much fuel in the form of food, as they take life easy. They prefer to lie in the sun or float lazily along the water surface, rather than tear around the way mammals and birds do. Also, they are much more efficient at using the food they eat, with very little wastage. Their excellent digestive system even digests bones. So crocodiles can get by with much less. For example, a big male mugger at the Crocodile Bank, weighing over 150 kilos, eats only 20 kilos of meat per month. This is even less than an Alsatian dog needs.

Every December, the big, dominant male muggers start displaying their power by 'jaw slapping' and growling. Jaw slapping is a loud, splashing noise produced by the crocodile actually snapping its jaws on the surface of the water. They cruise their water habitat with strong sweeps of their tail, searching for mates. Mating takes place in the water, and a month later the female has to start thinking about laying her eggs. She finds a safe, undisturbed sand or earth bank near the water's edge to make her nest. Sometimes she digs several trial nests with her hind feet before choosing the perfect place. Then, one night, she lays twenty to thirty large, hard, white, eggs and covers them carefully with earth. These are about three times the size of hens' eggs.

For seventy or eighty days, the eggs incubate underground and



The three crocodilians found in India may be easily identified: the gharial (right) has the thinnest jaws. The mugger (middle) has the broadest. The saltwater crocodile (left) has a longer snout than the mugger and no large scales behind its head

the embryos develop. The female is never far away and often stays out of the water at the nest, especially at night when predators are around. She is very aggressive at this time and chases away any creature that comes near her eggs. And with good reason, because monitor lizards, jackals, wild boar and others welcome a meal of tasty crocodile eggs.

Of all the reptiles, crocodiles are the best parents. The male will

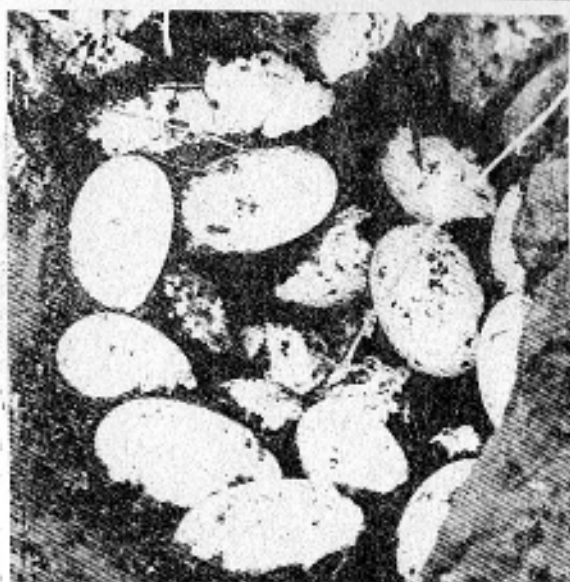
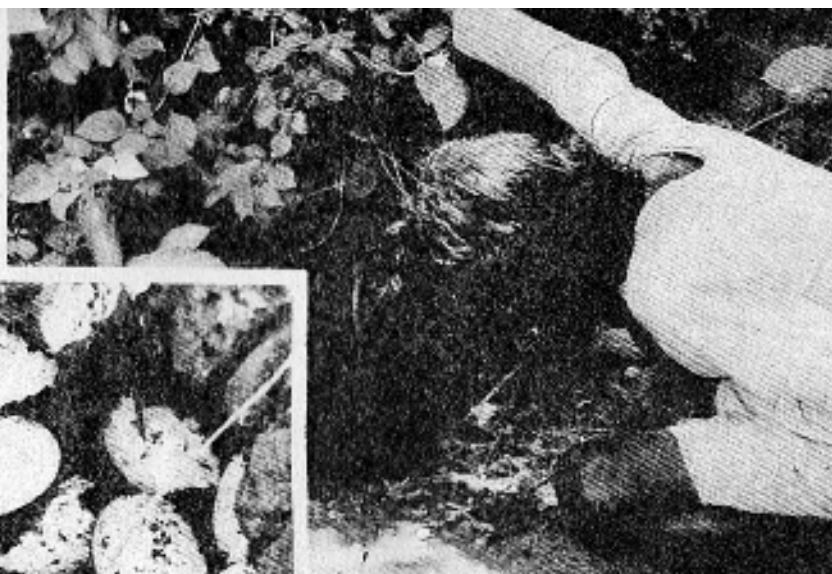


Courting muggers. Males are generally larger than females in crocodilians

often share nest guarding duties with the female. When hatching time arrives, they both open the nest and care for the young. When ready to hatch, the baby crocodiles make small squawking noises inside the eggs: "urk, urk, urk". Soon there is a faint chorus of baby crocs which the mother or father can hear if they are near the nest. The parents dig out the eggs. Some of the babies may already have hatched. The strong crocodile jaws, capable of killing a buffalo, pick these up gently, and carry them to the water. The unhatched eggs are also picked up, and, with gentle pressure, hatched in the mother's mouth! Since ancient times people who have seen this remarkable behaviour have thought that the parent crocodiles eat their young.

The babies form a group, or pod as it is called, and stay

Exploring a
mugger tunnel



A nest of the mugger exposed to show the
elongated eggs

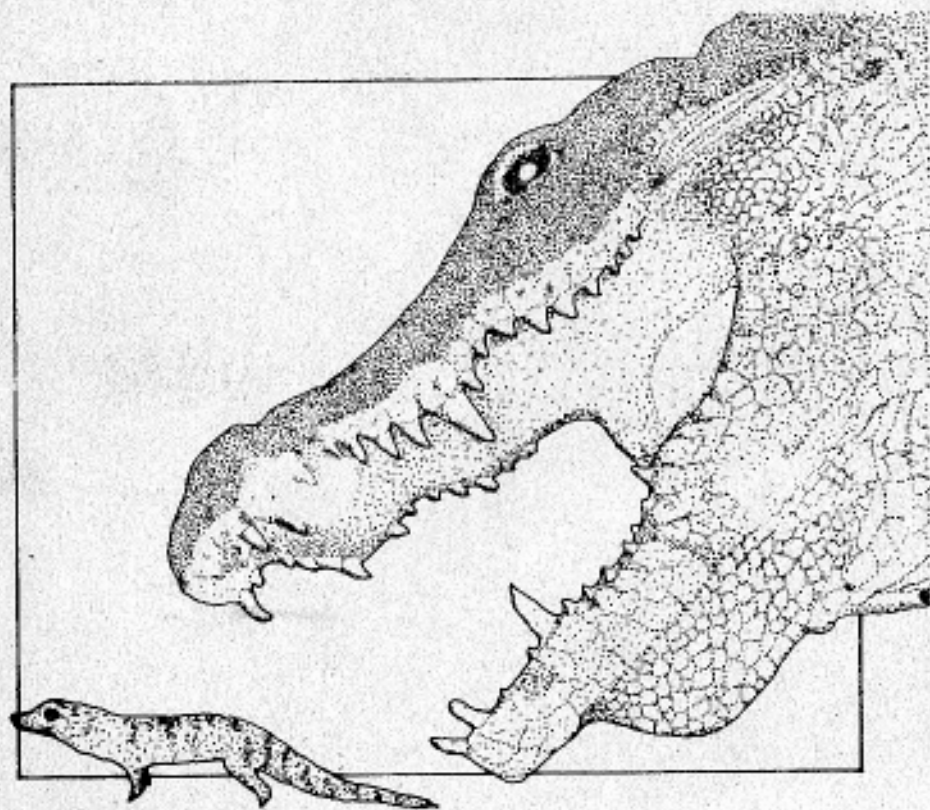
with one or both parents for up to several months. Then the 35 cm (14") long babies must get out into the world on their own. They have many enemies: from big fish to wading birds, snakes and mammals. In fact, a hatchling crocodile has only a small chance of becoming an adult. It must reach over a metre in length (3½ feet) before it is able to escape most of the predators in the wild. Unfortunately, this is when human beings start preying on them,



Male Mugger looking after hatchlings

for meat and skins! Most of the twenty-two different kinds of crocodiles in the world have been killed, and almost finished off, by the leather industry. Sadly for them, their skins are one of the toughest and most beautiful on earth. More on this in the section on crocodile ranching, farming, and their uses in the wild.

A hatchling mugger crocodile being gently picked up by its parent at hatching time



Much of what we have said about nesting and hatching is true for many crocodile species around the world.

The Saltwater Crocodile

The 'salty', as crocodile people call it, is the king of crocodiles and the largest reptile on earth. It reaches 7 metres (27 feet) in length and some weigh over a tonne, which is a thousand kilos. No reptile as big as the salty has roamed the earth since the age of the dinosaurs. We had heard stories of twenty-foot salties, but it was in Papua New Guinea that we finally saw and measured one. It was a huge old male which had been unlucky enough to get caught in a fish net on the Fly River. It drowned, and when we arrived the next day the villagers were busy skinning it. There was a whole deer in its stomach, weighing 40 kilos! The length of the 'salty' was over 6.2 metres or 20 feet.

Though a twenty-footer may regularly feed on deer and other big animals, the average-sized salty (10–13 ft or 3–4 metres) eats crabs, fish, frogs and other small prey. Like all crocodiles, they have to be quiet and cunning in order to catch prey. They keep hidden, and sneak close to their victim. Then they use their incredible agility and speed to make the final rush.

Once we watched a big salty move slowly towards the bank of its pond, making an arc of its body. We soon guessed what it was doing. It trapped a school of fish between its body and the shore. As the crocodile moved closer, narrowing the gap, the fish began to jump, frantically. Some flopped out on to the shore, others landed on the crocodile's back and jumped free. But the salty was able to grab several fish, some of which swam right into its half open jaws! There are stories of salties that wait day after day for an animal to come to a certain drinking spot on a river or pond. It seems that



crocodiles can think and figure out new ways of catching prey.

The saltwater crocodile is found all the way from India east to Australia. Of all the crocodiles in the world, this species and the Nile crocodile have the reputation of sometimes being man eaters. It is unfortunately true that a big crocodile will sometimes lose its fear of human beings and start attacking them and cattle.

In Irian Jaya, Indonesia, Rom interviewed witnesses of a dozen fatal attacks by a crocodile in the village of Sawa-Erma. There are plenty of salties in the area but only one was causing trouble. It was later trapped and shot. But the local people were sure that it was the spirit of a villager who had died long ago.

Salties live in brackish swamps and at one time they were common in coastal India. Today they are found in only three places in this country: the Andamans and Nicobars, and the mangrove swamps in Orissa and West Bengal. Here attacks on human beings are very rare. In croc country, as in elephant or tiger country, people learn to avoid putting themselves in danger. In Australia, thousands of tourists visit rivers which abound with large salties, and aborigines there have been living with crocodiles for many thousands of years.

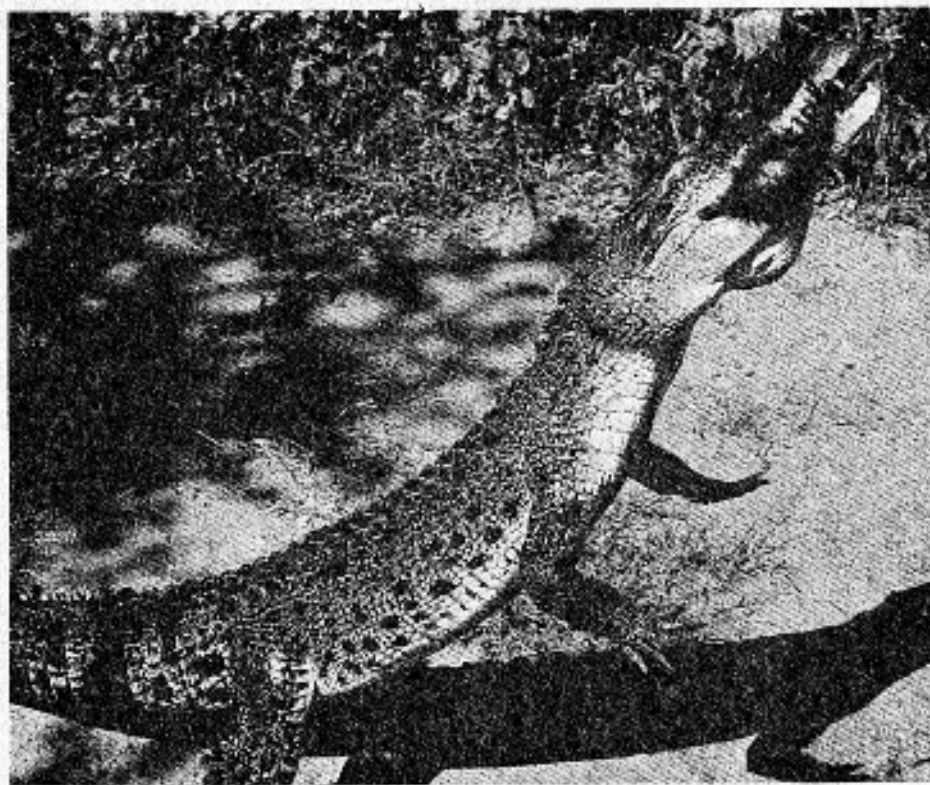
Salties court and mate much the same way as do other crocodiles. But they are much more territorial than the mugger. During the breeding season, smaller males have to stay out of the way of the big adult females and males, or they could be killed.

The biggest difference is the nest. The female saltwater crocodile builds a fine, large nest mound of leaves and sticks. In this, she digs a hole at the top to lay her fifty to eighty eggs. If the nest is near water, she will guard it from the nearest channel. But salties usually nest at the edge of mangroves, where the freshwater swamps meet the tidal zone of the sea. Thus, there is often no

← This saltwater crocodile skull may be the largest in the world. The croc was said to be over 6 metres long

suitable water-way. So the female digs herself a wallow that fills with water, and lies in it to protect her eggs. From experience, we have learned to respect a female salty defending her nest or babies. At the Madras Crocodile Bank we take the eggs from nests to incubate them in the lab. It is an exciting event that might be enjoyed by bull fighters, motor cycle racers and other dare-devils.

A saltwater crocodile can leap up to catch its prey



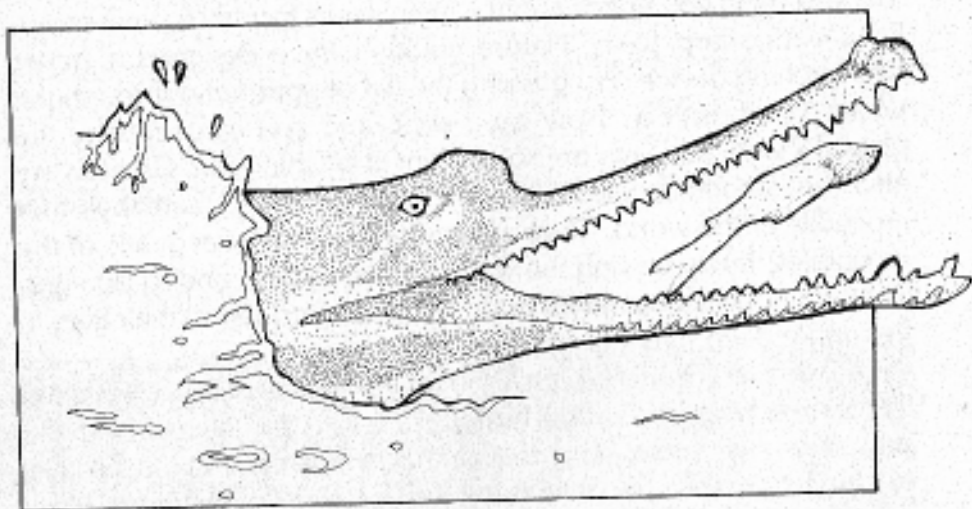
The Gharial

The first thing you notice about a gharial is its incredibly long snout, lined with sharp teeth. Nature couldn't have designed a better fish-catching device. Try pushing the flat of your hand through the water. Hard, isn't it? Now try a stick, and you can see why the gharial's long, thin jaws are so efficient at catching fish. Gharials are also very smooth-bodied and streamlined, more so than any other crocodile in the world. They are certainly the most aquatic of the crocodiles, rarely leaving the water except to bask and to lay eggs. They do not walk overland, as do muggers, and spend their lives in the large, deep rivers of northern India.

It was marvellous to watch the gharial in the clear water of the Ramganga river in Corbett National Park. A fish swims near the still, submerged form and the gharial suddenly snaps sideways, catching it. At the Crocodile Bank we watch the gharial feed every day, and we are always impressed at how fast and accurate they are. Many a time we have thrown fish to them, which they catch in mid-air, or on the bounce. Small gharials sometimes run right out of the water with a big fish, presumably in case they can't hold on to it.

Like the mugger, gharial breeding begins in the winter months. When mature at about twelve to fifteen years, the male gharial grows a big knob on its snout called a 'ghara', the Hindi word for pot. In fact this is the only crocodile in which males and females are different.

The 'ghara' grows right over the nostrils and, when the gharial makes the usual hiss of a crocodile, it gets amplified. It becomes a loud buzzing sound which probably helps to attract females as well as to tell other males in the area to keep away. Gharials are usually gentle animals, but males may have fierce fights during the



The narrow jaws of the gharial are clearly best for catching fish, the main food of this crocodilian

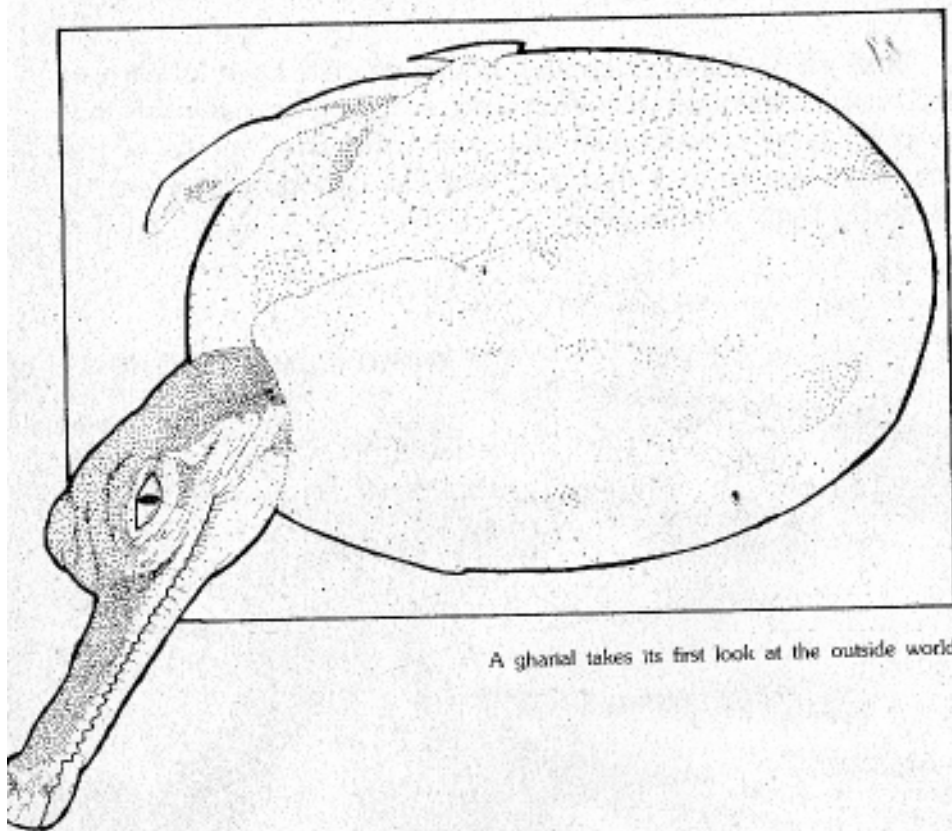
breeding season and females defend their nests with ferocity.

Females lay forty to eighty eggs in March or April on the high silt and sand banks of the big rivers in the north. These include the Mahanadi in Orissa, the Chambal in Rajasthan and Madhya Pradesh and several tributaries of the Ganga and Jamuna that flow down from the Himalaya. The eggs incubate in the sand for about seventy days and, when the babies are ready to hatch, they call from inside the egg. This is the signal for the female to dig them out. No one has ever seen a gharial picking up a baby in those formidable, toothy jaws. It seems that the mother just leads the young to the safety of water.

Like all hatchling crocodiles, young gharials have to learn to feed themselves from the beginning, snapping up baby fish that swim in large schools near the river bank. The snouts of the hatchlings are so long that they look like cartoon characters, or creatures from another planet.

An adult male gharial catches a large fish





A gharial takes its first look at the outside world

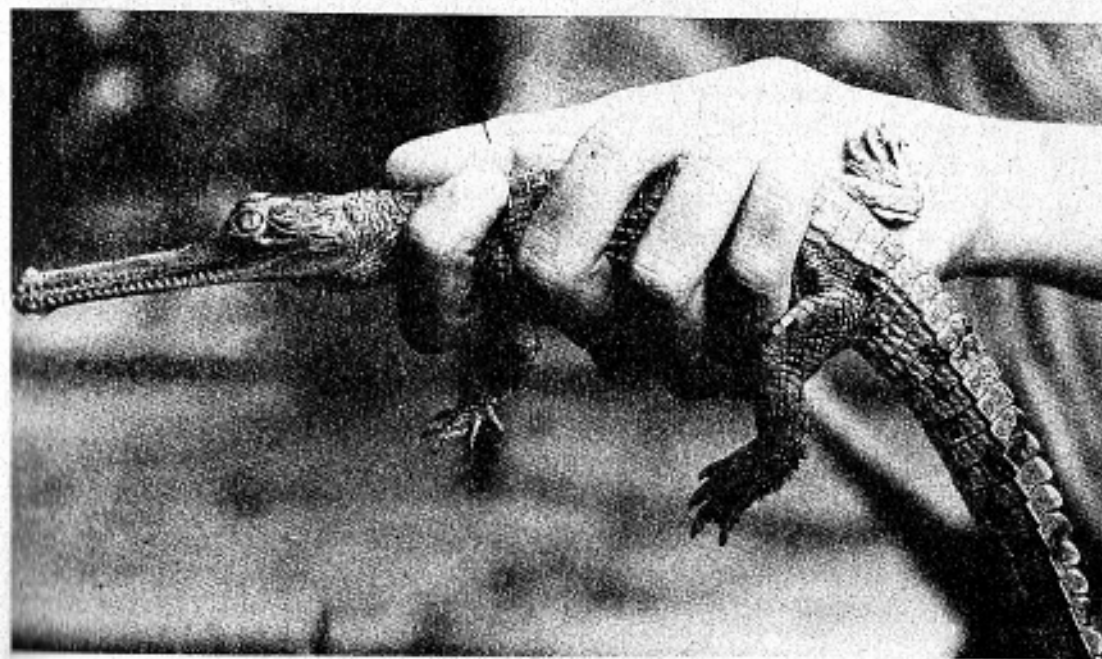
Project Crocodile

Everyone has heard of Project Tiger, when the World Wildlife Fund chipped in a million dollars to help save the rare Indian tiger. In 1975, the Food and Agriculture Organisation of the United Nations started a crocodile project to help India save the three Indian crocodiles from extinction.

In the early 1970s, we carried out surveys of crocodiles in north India, and later, in Nepal and Bangladesh. Less than 200 wild gharials survived. The mugger was better off, with two or three thousand scattered throughout the country. There were many more on the island of Sri Lanka, where we travelled for forty days by motorbike to look at crocodile habitats. The saltwater crocodile was in bad shape with only a few hundred left in India and their habitat rapidly dwindling.

Crocodiles had been killed in their thousands for their skins. Tribals and other local people collected the eggs for eating. Dam

A handful of baby gharial



projects and the cutting down of forests were changing their habitats so fast that there was a danger of them disappearing altogether.

Why save crocodiles? As master predators and scavengers, crocodiles keep the water system clean. They raise the genetic quality of the animals they feed on, since they aim for the weak, sick and injured. Like the tiger in the forest, crocodiles are at the top of the pyramid of wildlife in rivers, lakes and swamps. Without them, nature becomes severely unbalanced, and unhealthy. For example, if crocodiles are killed off in reservoirs the destructive cat fish becomes a menace to commercial fishermen who catch carp and tilapia. In the Amaravathi Reservoir near Coimbatore, there is a healthy mugger population—and the commercial fish catch is the highest in the country! This is a good lesson for people who don't realize how important a crocodile is.

Biologists working on Project Crocodile collected crocodile eggs from the wild and carefully incubated them. The hatchlings were reared for two or three years and released in protected habitats. Now, ten years later, several thousand gharials, muggers and salties have been put back in the wild and many have started breeding. Naturally, crocodiles cannot be released in all the places they were once found in. India's human population has grown so fast that most areas which were wild fifty years ago are now totally changed.

Today, the mugger can be seen at the Amaravathi Reservoir in Tamil Nadu, Hiran Lake in the Gir Lion Sanctuary in Gujarat, the Ranthambor Tiger Sanctuary in Rajasthan and a few other places. Salties can best be seen in the winter months in the Bhitarkanika Sanctuary, Orissa, and in some areas of the Andamans. Gharials are best seen in the Chambal River National Park, the Mahanadi

Excessive hunting, mostly for their valuable skins, have made crocodiles and alligators rare in most parts of the world



river in Orissa or in the Chitawan National Park in Nepal. There is something very special and unforgettable about seeing a big crocodile basking in the morning sun, relaxing with its great jaws open.

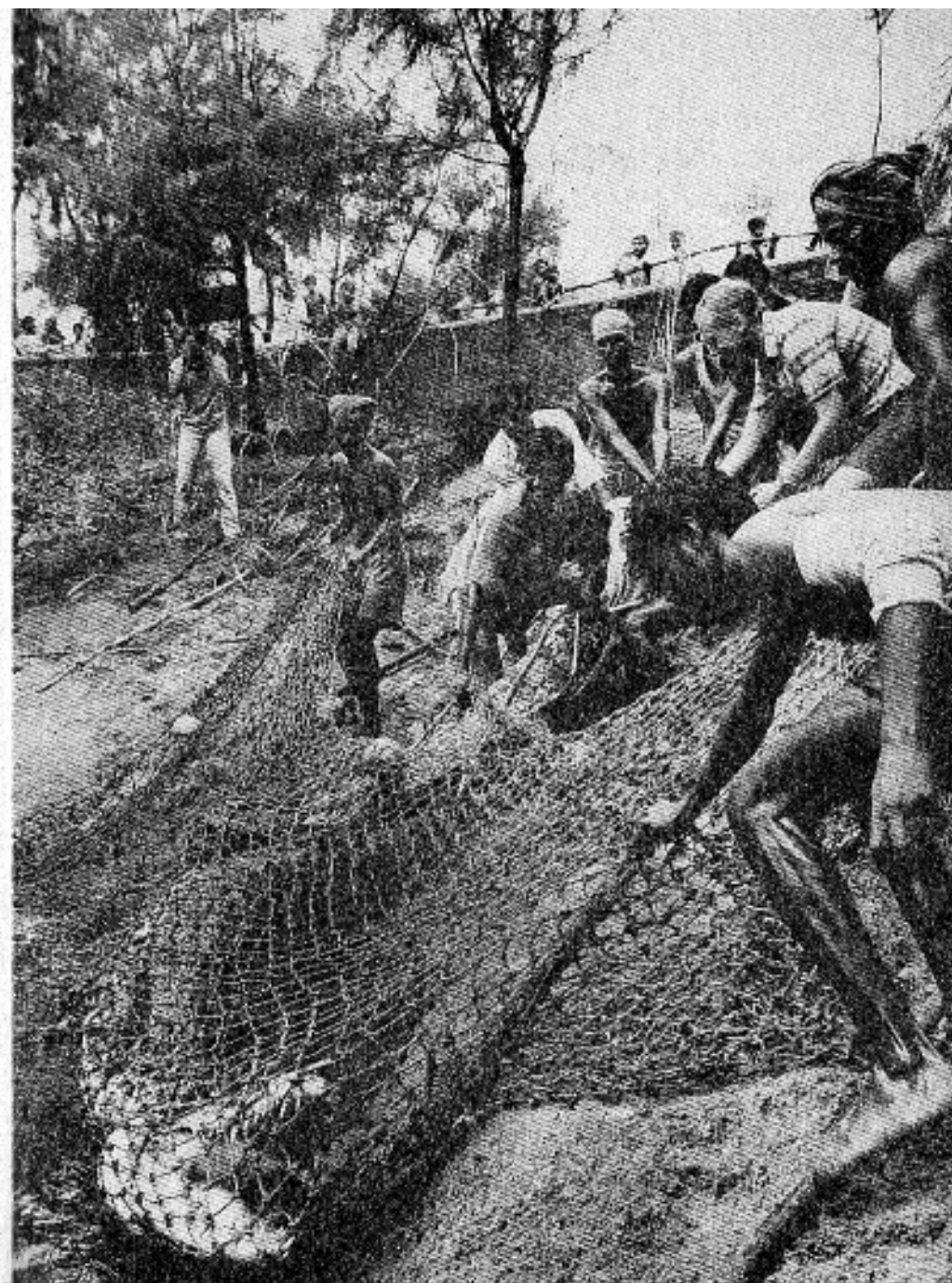
Studying Crocodiles

Apart from doing surveys on how many crocodiles are left in the wild, studies have been carried out at the various government crocodile farms as well as at the Madras Crocodile Bank.

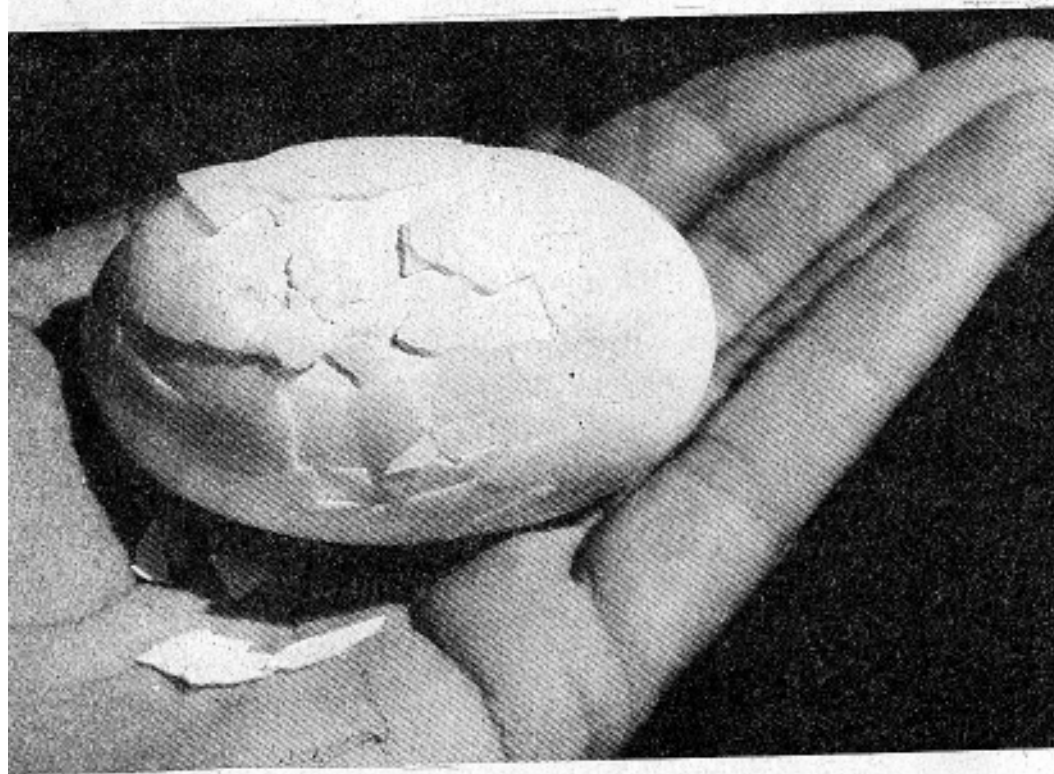
These young South American spectacled caiman will develop prominent ridges over their eyes, that give the species its name



Catching a big crocodile using a net →
(Photograph Shaker Dattari)



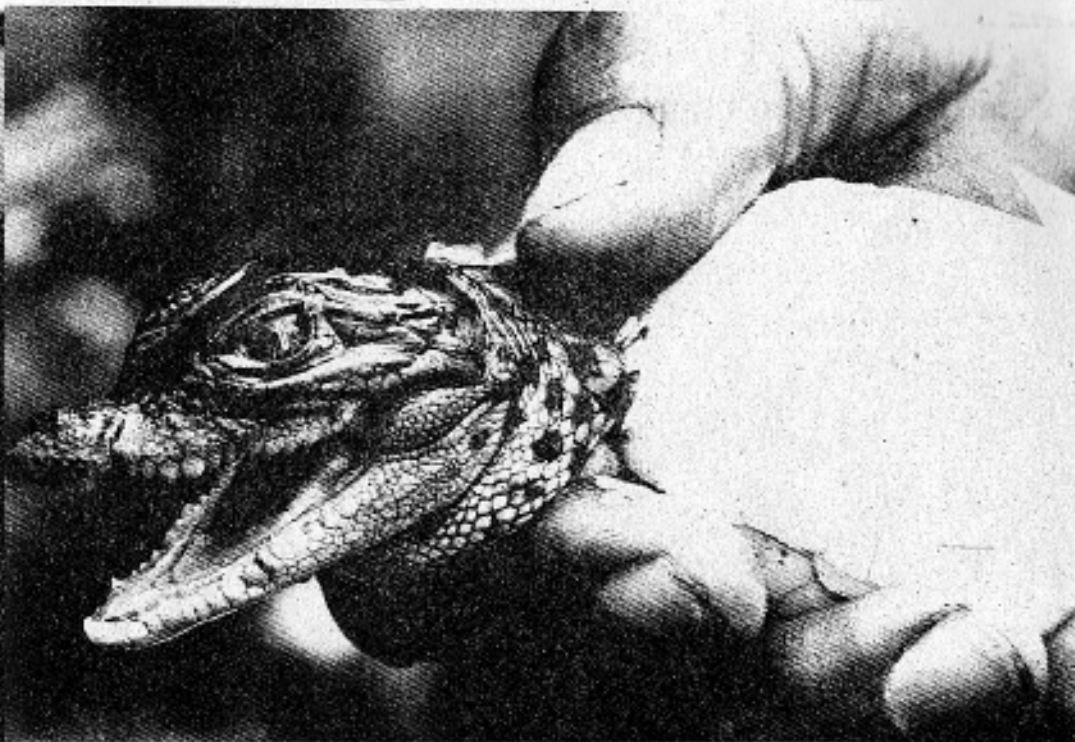
At the Bank, we have been doing research with the help of the Smithsonian Institution and the National Geographic Society since 1985. The most incredible finding is that, as with turtles, the sex of



A crocodile egg about to hatch

a crocodile embryo is determined by temperature. But unlike turtles if we incubate eggs between 28° and 31°C the hatchlings are all females, and the eggs take nearly a hundred days to hatch. If incubated at 32.5° , they are all males, and take sixty-four days to

hatch. Between 32.5° and 33° , both males and females are obtained. In mammals and birds the sex of the offspring is determined by genetics.



Newly hatched mugger

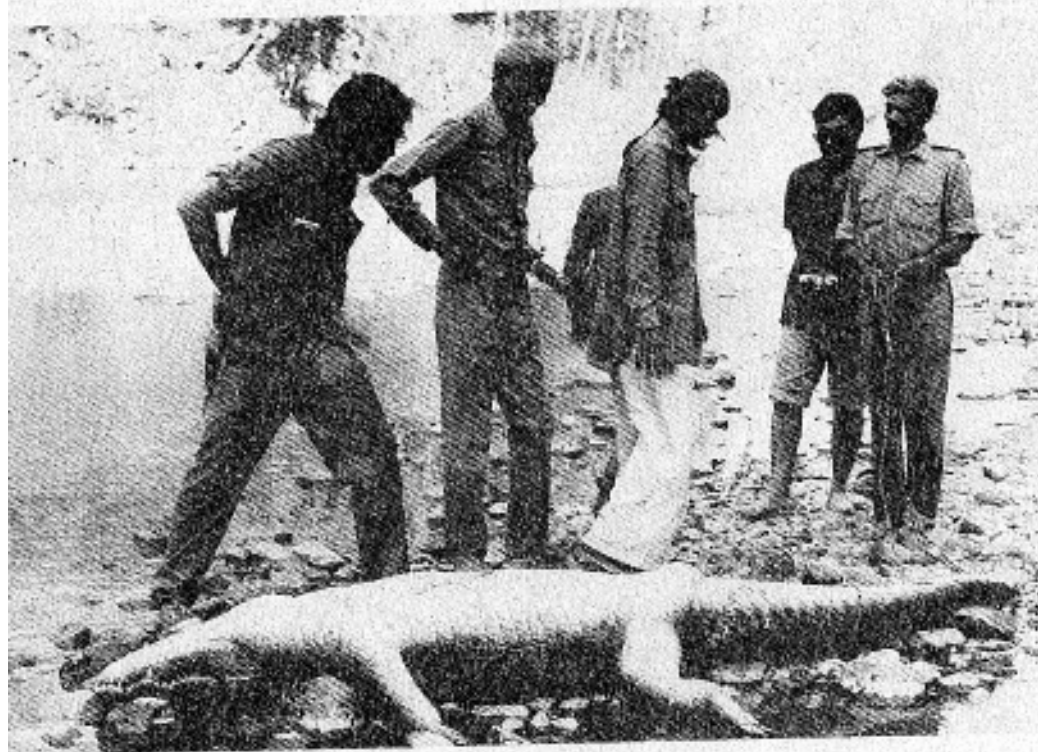
Other studies have been carried out on the feeding, diseases and behaviour of crocodiles, and on how temperature affects them as they grow. Growth experiments show that they can reach over a metre in length in just one and a half years.



In two years, crocodiles can grow to 15 feet long.

Crocodile Farming

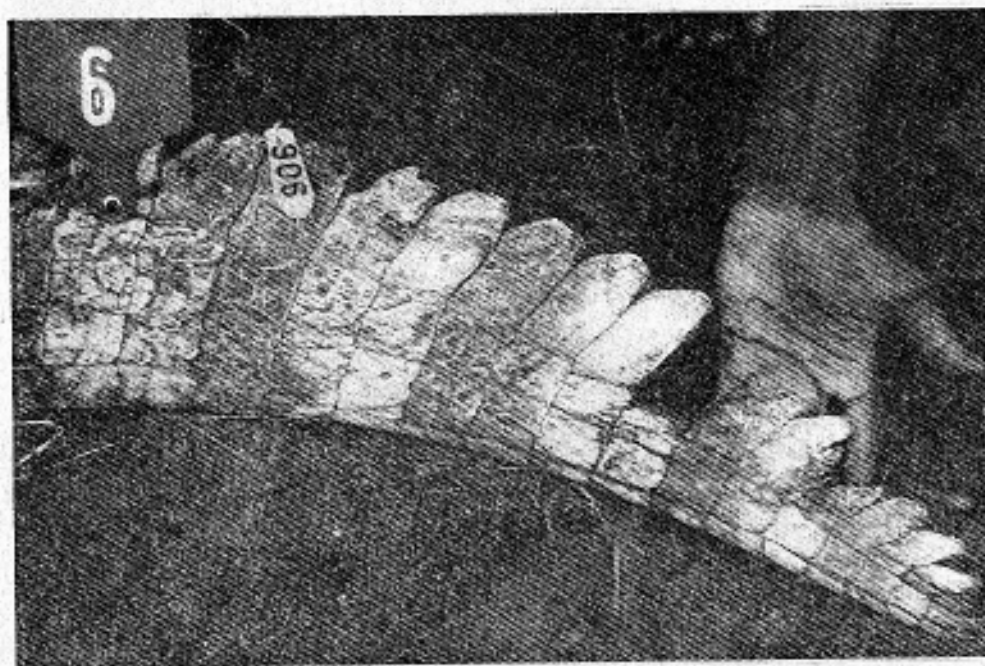
As you know, human beings have domesticated many kinds of mammals and birds over the centuries, producing breeds that are very helpful to them from the fast growing broiler chicken to breeds of dogs that are used for many different purposes. Well, man has now domesticated the first reptile—the crocodile. In many



A dead mugger, probably killed by a bigger one

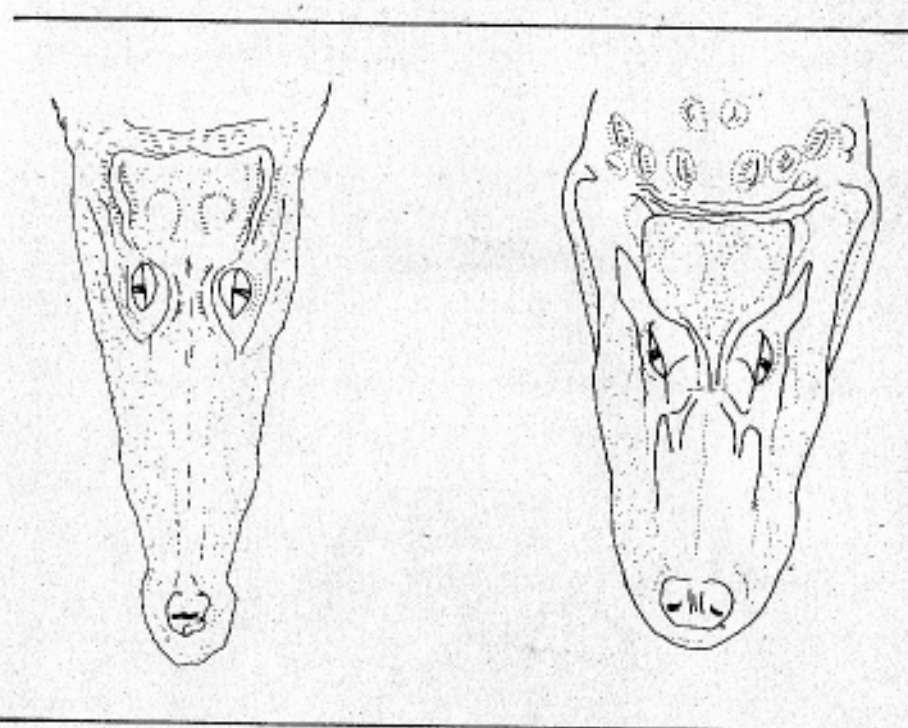


countries, including Australia and the United States, tens of thousands of farmers raise crocodiles and alligators for their valuable skins and tasty meat.



The tail of a crocodile, showing the numbered tags by which it can be recognized later

Alligators found in the United States and China are very dark animals with light markings and broad snouts. The teeth of the alligator fit into sockets in the jaw, making them inconspicuous. Crocodiles are found in tropical countries, they have narrower snouts, are generally light in colour with dark markings and all their



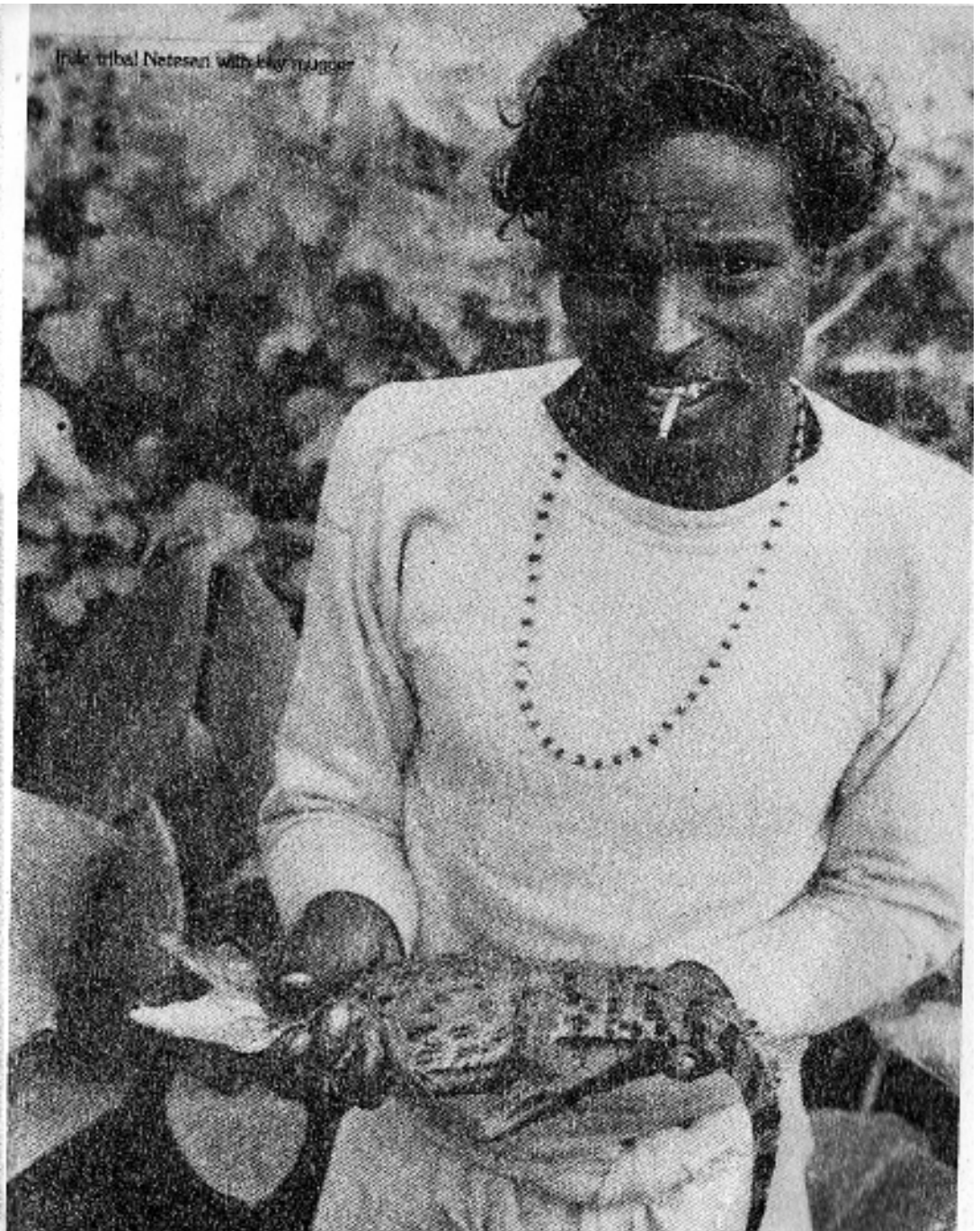
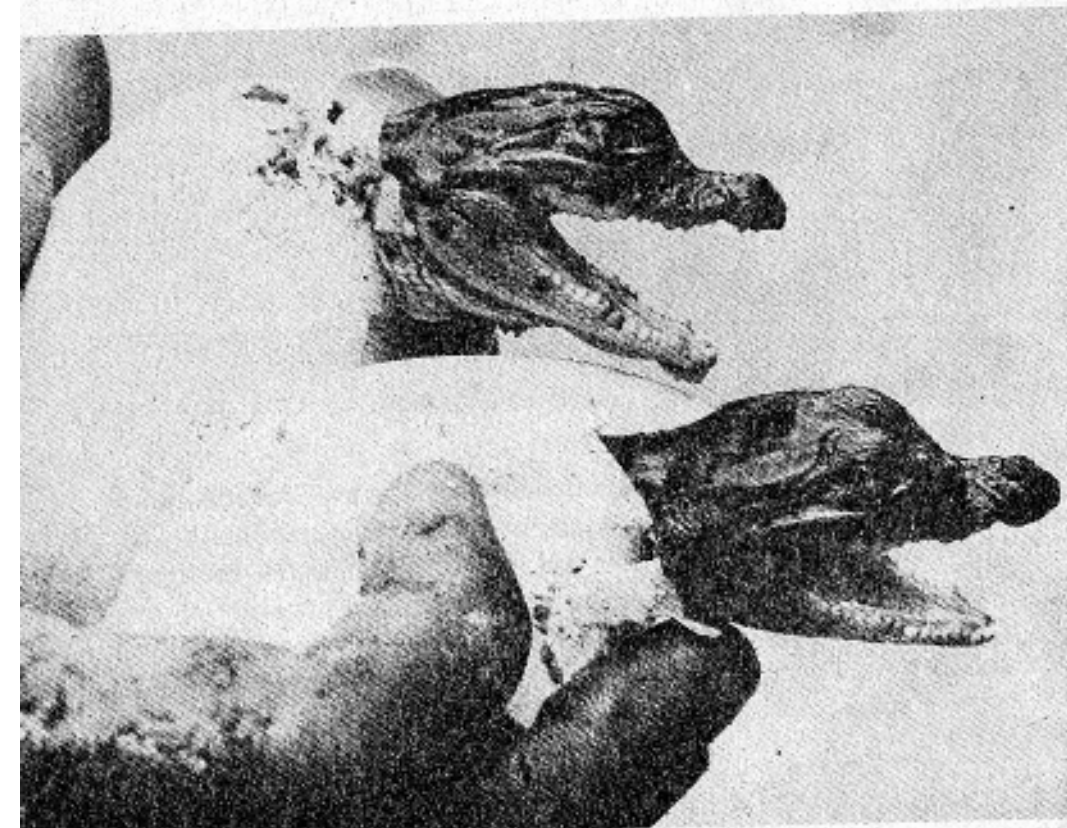
Broad snout of an alligator as compared to the sharper snout of a saltwater crocodile

teeth overlap, giving them that typical 'toothy' grin. Crocodiles and alligators have been bred in captivity for several generations, and are now 'domestic'. While it is sad to kill these animals, biologists feel it may be the only way of saving them. As we know, the human population of India and other tropical countries is growing so fast that wildlife will have a hard time surviving. Every year, one animal species becomes extinct. Animals that people are afraid of

and don't like too much, like crocodiles, have little chance of surviving unless people can be convinced that they are useful to them.

If people get interested in the value of crocodiles they would also have good reason to protect swamp land waterways. A healthy, wild population of crocodiles can produce millions of

The Madras Crocodile Bank in Tamil Nadu hatches out thousands of baby mugger each year



Indian tribal Natesari with baby mugger

rupees worth of eggs and offspring each year if the resource is carefully harvested. Valuable wild habitats would be protected in the bargain.

It seems likely that the future of many wild animals lies in their carefully controlled use for meat, skins and other products. At the same time, healthy natural populations must be left in the wild. This is the new challenge for wildlife managers. They must make sure that ours is not the last generation to see the great crocodiles in the wild, the "last of the ruling reptiles".

American alligator hissing an open mouthed threat

